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Revision of the Australian Bee Genus *Trichocolletes* Cockerell (Hymenoptera: Colletidae: Paracolletini)

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ABSTRACT. The endemic Australian bee genus *Trichocolletes* is revised. Forty species are recognised, including twenty-three new species: *Trichocolletes aeratus, T. albigenae, T. avialis, T. brachytomus, T. brunilabrum, T. capillosus, T. centralis, T. dundasensis, T. fuscus, T. gelasinus, T. grandis, T. lacaris, T. leucogenys, T. luteorufus, T. macrognathus, T. micans, T. nitens, T. orientalis, T. platyprosopis, T. serotinus, T. simus, T. soror* and *T. tuberatus*. Four new synonymies are proposed: *Paracolletes marginatus lucidus* Cockerell, 1929 = *T. chrysostomus* (Cockerell, 1929); *T. daviesiae* Rayment, 1931 = *T. venustus* (Smith, 1862); *T. marginatulus* Michener, 1965 = *T. sericeus* (Smith, 1862); *T. nigroclypeatus* Rayment, 1929 = *T. venustus* (Smith, 1862). *Trichocolletes rufus* (Rayment, 1930) is moved to *Leioproctus* and *T. rufopilosus* (Rayment, 1935) to *Anthoglossa*. Descriptions are given for new species and redescriptions for species described before 1965, including first descriptions of males of *T. aureotinctus* (Cockerell), *T. burnsi* Michener, *T. latifrons* (Cockerell) and *T. maximus* (Cockerell) and the females of *T. dowerinensis* Rayment and *T. rufibasis* (Cockerell). Lectotypes are designated for *Lamprocolletes venustus* Smith and *Anthoglossa plumata* Smith. Keys to species are provided for both sexes, as are distribution maps and a summary of recorded floral visitation.

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The monobasic genus *Trichocolletes* (Cockerell, 1912) was erected for the species *Lamprocolletes venustus* Smith by virtue of its conspicuously hairy eyes. Rayment (1929, 1931) added four additional species so that Cockerell's 1934 survey of the family Colletidae in Australia, listed five names in the genus *Trichocolletes*. When Michener (1965) revised the genera of Australian bees, he recognized that species without hairy eyes, previously placed in *Anthoglossa* and *Paracolletes*, belonged in a more broadly defined genus. At the same time Michener created a separate subgenus for the species *T. pulcherrimus* Michener, a decision he recently suggested (Michener, 2007) might merit reexamination. Since 1965, two new species have been added (Houston, 1990), but there has been no revision of the genus. This is, therefore, the first species-level revision of the genus *Trichocolletes*.

A recent molecular phylogeny of the family Colletidae (Almeida & Danforth, 2009) concluded that the Australian and South American genera traditionally included in the tribe Paracolletini (Michener, 2007), excluding *Callomelitta* and *Paracolletes s. str.,* form a monophyletic group and it has been proposed (Almeida *et al.*, 2012) that the name Neopasiphaeinae should be used for this group. The phylogenetic analysis suggested that the genus *Anthoglossa* is sister to all other Neopasiphaeinae and the genus *Trichocolletes* is, in turn, sister to all Neopasiphaeinae other than *Anthoglossa*. Until morphological clarification of the status of *Paracolletes* is available, we have opted to follow Michener's (2007) family-level names.

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Figs 1–2. *Trichocolletes venustus*, male: (1) fore basitarsus showing plume (2) hind leg (part) showing long hair on femur.

For the present study almost all available material in Australian collections was examined and type specimens were either seen by the authors or examined by experts at the institutions housing them.

Bees of the genus *Trichocolletes* are found only in Australia in the south-eastern temperate, south-western temperate and eremean biomes (as defined by Crisp *et al.*, 2004). Information on behaviour is limited. Many species are active in late winter and spring and the common species of the east coast have been reported (Hacker, 1918; Rayment, 1929, 1935) to show a preference for pea flowers, while a more comprehensive survey of flower visiting records for Western Australian species (Houston, 2000) demonstrated that the bees forage from other flower families as well. Members of the genus have been identified as important pollinators of *Diuris* orchids (Indsto *et al.*, 2006).

Terminology, methods and measurements

The morphological terminology follows that used by Michener (2007) and Harris (1979), including interchangeable use of the words hair and seta. Relative dimensions quoted in the descriptions were measured using an eye-piece graticule on a stereomicroscope with the zoom objective set to give a reading of 50 divisions for the head width. Abbreviations used for the measurements are as in Houston (1990) and are as follows: as follows: *AOD* antennocular distance; *ASD* antennal socket diameter; *BMW* basal width of mandible; *DMA* distance between anterior mandibular articulations; *FL* flagellum length; *HL* head length; *HVO* height of vertex above lateral ocelli; *HW* head width; *IAD* interantennal distance; *LID*; lower interorbital distance; *ML* mandible length; *MOD* diameter of median ocellus; *MSL* malar space length (shortest distance between the abductor swelling and the eye); *OOD* ocellocular distance; *SL* scape length; *SW* scape width; *UFW* upper width of face; *UID* upper interorbital distance; *WOC* width of ocellar cluster. Measurement of the length of the hind tarsus excludes the claws. Metasomal terga are referred to as *T1, T2* etc. and sterna as *S1, S2* etc. *S7* and *S8*, the "hidden sterna" of males, exhibit useful diagnostic characteristics and were extracted for examination. Individual antennal flagellomeres are referred to by number as *F1, F2* etc.

All but three of the type specimens were examined by one of us (MB). The exceptions were examined and photographed by colleagues in the holding institutions on our behalf.

Descriptions are arranged alphabetically.

To minimize repetition in the specific descriptions, eyes are described as "not hairy", rather than "with scattered, minute setae". Many males carry a dense fringe of long, sinuous hair on the posterior margin of the fore basitarsus. When the hairs are longer than twice the width of the basitarsus, the fringe is called a plume (Fig. 1), otherwise it is called a brush. The section of the epistomal suture that separates the clypeus from the supraclypeal area is called the basal suture of the clypeus. The widths of metasomal bands are difficult to measure with any precision, but there are discernable differences between species. Metasomal bands are described as "narrow" if the width of the band on T2 is less than ⅕ the distance from the gradulus to the apex of the tergum, measured medially, and "wide" when the band width is more than ¼ of that distance.

Characters of individual species are described only where they differ from the typical condition given in the generic description. Unless otherwise noted, the body lengths of all specimens examined were within ±1 mm of that for the specimen described. Sexes were associated by morphological similarity and coincident collection, except where noted otherwise.

Geospatial coordinates are GPS readings and distributions include Interim Biogeographical Regions of Australia codes (IBRA, 2010) in parentheses. The following abbreviations are used for collections in which the specimens are lodged: AM, Australian Museum, Sydney; AMNH, American Museum of Natural History, New York; ANIC, Australian National Insect Collection, Canberra; BMNH, British Museum (Natural History), London; MV, Museum Victoria, Melbourne; OUM, University Museum, Oxford; QM, Queensland Museum (now including the former UQIC, University of Queensland Insect Collection), Brisbane; SAM, South Australian Museum, Adelaide; WAA, Western Australian Department of Agriculture Insect Reference Collection; WAM, Western Australian Museum, Perth.

Systematics

Genus *Trichocolletes* Cockerell

Trichocolletes Cockerell, 1912, p. 176; Michener, 1965, pp. 78–80. Type-species *Lamprocolletes venustus* Smith, 1862 (original designation).

Diagnosis

Moderately large bees (length 10–18 mm) distinguished by the following combination of characters: fore wings with three submarginal cells; pterostigma short, parallel-sided, ending at, or slightly beyond, base of vein r; basitibial plate of female hidden by setae and incompletely defined; inner hind tibial spur of female almost palmate (Michener, 2007, fig. 39–11b), of male, ciliate and broadened basally; labrum of both sexes at least 0.4× as long as wide, usually polished and smoothly convex, occasionally tectiform; mandibles bidentate, approximately parallel sided; compound eyes of some species covered with conspicuous, long setae; metasomal terga with apical, integumental bands usually metallic gold or silver but sometimes testaceous and inconspicuous.

Descriptions

Male. Face usually quadrate (eye length equal to interorbital distance at level of antennal bases), but sometimes wider than long; clypeus transversely convex, flat or weakly convex longitudinally; glossa broad, bifid: labial and maxillary palpi usually slender, almost reaching end of glossa; labrum uniformly convex (but with a tubercle in one species), length 0.5 to 0.8× width with apical fringe of bristles; mandible bidentate, straight or gently curved, often slightly twisted about longitudinal axis; scape occasionally swollen, but usually slender; gena c. half as wide as eye viewed laterally, rarely wider; flagellum 20% shorter than to 50% longer than head width, occasionally modified apically.

Legs usually slender, occasionally modified; tarsal claws deeply cleft; fore tibial calcar usually with strong apical spine, several long, fine teeth and rounded velum; hind basitibial area usually flattened with a posterior carina, but rarely forming a distinct plate; propodeum smoothly declivous; wings with three submarginal cells, stigma short, just reaching or slightly exceeding vein r.

Terminalia: genital capsule elongate with large gonoforceps, obliquely truncated with long, plumose apical hair, occasionally with simple hair or bare (Figs 29–40); volsellae of moderate size, not enlarged as in *Anthoglossa* (Michener, 1965, figs 197, 192); S8 simple with spatulate apex, narrow neck and cordate base, with only minor interspecific variation (Figs 41–43); S7 variable in form and diagnostically valuable (Figs 44–79), but retaining a combination of characters unique to this genus: partially hollow lateral lobes (arrowed *b* and *e* in Fig. 44), posterior margin usually with pair of blunt, hirsute projections (arrowed *a* in Fig. 44), surface extensively covered with long hair, anterior margin of lobes extended into ligulate processes (*d* in Fig. 44), frequently with a stout triangular tooth with serrated edges near base of each ligulate process (*c* in Fig. 44).

Scape, labrum, mandibles medially and legs usually orange-brown; apical part of clypeus sometimes orange-brown or cream; metasomal terga sometimes wholly or partly red or orange-brown; apical bands of T1–5 usually gold, silver or white; that of T6 translucent; sterna sometimes with narrow translucent margins.

Clypeus, except ventral rim, usually densely punctate; frons and vertex finely reticulate and closely punctate; mesosoma either with a dull sheen or matt due to fine pit-reticulation that is sometimes strong enough to obscure the close punctures; metasomal terga dull or weakly shining, with weak, irregular, transverse lineolation or occasionally pit-reticulation (in which case the apical bands are lineolate), frequently surface is further roughened with broad, indistinct punctures or scrobiculi.

Eyes with either conspicuous cover of long setae or nearly bare with only scattered, minute setae; face usually densely covered with orange or white hair; mesosoma excluding propodeal triangle usually conspicuously hairy; scutum with finely-branched, moderately long hair; scutellum, metanotum, mesepisternum and sides of propodeum with somewhat longer and more plumose hair, often orange-brown, becoming paler ventrally; fore basitarsus frequently with a plume of long, sinuous hair; coxae, trochanters and femora with mid-length or long, finely-branched hair, usually open but sometimes close or dense; T1 sparsely covered with long, erect, pale hair; T2 usually with similar, shorter hair; remaining terga with sparse or open simple, short, semi-erect hair matching the colour of the underlying integument (inconspicuous when viewed perpendicular to the surface, but often reflective creating a sericeus appearance when illuminated obliquely); sterna with open covering of long, semi-erect, finely-branched pale hair, rarely with dense hair tufts.

Female. As for males, except clypeus often flattened sagittally; rarely labrum tectiform; scape always slender; flagellum between 0.55× and 0.72× as long as head width, never modified.

Tibiae and basitarsi broader and flatter than in males; hind basitibial area usually obscured by dense stiff, curved setae; tarsal claws simple or with an inner ramus; pygidial plate with or without a longitudinal elevation, apex rounded or truncate, emarginate or entire.

Clypeal punctures seldom dense, interspaces often reticulate, especially towards base. Facial hair usually paler than that of male and dense only in paraocular areas and on frons; scutal hair usually shorter and duller than in male; setae of hind basitibial area usually darker than those on surrounding areas; hair of hind femur and outer face of hind tibia plumose; T5 obscured by prepygidial fimbria.

Colour variation. Colours reported in the descriptions are those for specimens in collections. The colours of some species *in vivo* are noticeably brighter. The thoracic hair of foraging female *T. hackeri* (Cockerell), for example, may appear to be mid- to light grey, but darkens considerably within hours *post mortem*. Similarly, *T. maximus* (Cockerell) looks to have brighter orange scutal hair when flying and the sericeus reflections from *T. micans* n.sp. when foraging in sunlight are so bright that the metasoma appears to be covered with pollen.

New combinations

Michener (1965) listed 21 names and Houston (1990) added two more. Of these names, four are synonymized and two are removed to other genera. *T. rufus* is removed to *Leioproctus* on the basis of *(a)* the pterostigma, which although short, is considerably longer and wider than in any *Trichocolletes* species, *(b)* the labrum which is short (0.2× as long as wide), *(c)* inner hind tibial spur, which is very long and uniform in width, not basally broadened as in *Trichocolletes, (d)* absence of translucent apical bands on metasomal terga, *(e)* polished area of propodeum and *(f)* very short first flagellomere. The hind basitibial plate is complete and carinate, albeit weakly pigmented, though this by itself would not be a reason to exclude the species from *Trichocolletes*.

Trichocolletes rufopilosus is removed to *Anthoglossa*. The type specimen has been dissected by the original describer and the genitalia are mounted with the specimen. The greatly enlarged volsellae are typical of those found in *Anthoglossa* species and the type specimen was indistinguishable from an undescribed species of *Anthoglossa* commonly found in the Avon wheatbelt area of Western Australia. Males of this undescribed species have been collected with females having tridentate mandibles and other characteristics of *Anthoglossa* species.

Key to males of the genus *Trichocolletes*

1	Eyes hairy	2
——	Eyes with minute setae only	18
2(1)	Scape mostly black	3
——	Scape mostly orange-brown, occasionally dark brown	9
3(2)	Labrum orange-brown; hind tibia and basitarsus broad and flattened	*T. dowerinensis* Rayment
——	Labrum black or dark brown; hind legs normal	4
4(3)	Labrum black; genal width approximately equal to eye width; vertex elevated	5
——	Labrum dark brown	6
5(4)	Scutal hair ferruginous, head length ≤ 0.7× head width	*T. maximus* (Cockerell)
——	Scutal hair pale orange-brown, head length c. 0.8× head width	*T. grandis* n.sp.
6(4)	Large tubercle on labrum	*T. tuberatus* n.sp.
——	Labrum smooth	7
7(6)	Seventh sternum with broad lateral lobes	*T. lacaris* n.sp.
——	Seventh sternum with narrow lateral lobes	8
8(7)	Hind tarsus as long as hind tibia; lobes of S7 straight (Fig. 68)	*T. micans* n.sp.
——	Hind tarsus 0.9× as long as hind tibia; lateral lobes S7 bowed (Fig. 49)	*T. brunilabrum* n.sp.
9(2)	Gena with dense white hair	10
——	Gena with open to close hair	12
10(9)	Labrum black; gena width 0.7× eye width; vertex elevated	*T. grandis* n.sp.
——	Labrum orange-brown; gena width c. ½ eye width; vertex normal	11
11(10)	Clypeus strongly protuberant	*T. leucogenys* n.sp.
——	Clypeus weakly convex	*T. albigenae* n.sp.
12(9)	Metasoma orange-brown with indistinct integumental bands	*T. brachytomus* n.sp.
——	Metasoma black with gold or silver integumental bands	13
13(12)	Metasoma with narrow silver or pale gold integumental bands	14
——	Metasomal bands gold, not narrow	16
14(13)	Mid and hind femora with dense, long hair (Fig. 4); S7 with little hair (Fig. 51)	*T. capillosus* n.sp.
——	Hair of mid and hind femora normal; S7 with normal amount of hair (Figs 70, 77)	15
15(14)	Scape with brown suffusions; fore basitarsal plume short, weak	*T. tenuiculus* Rayment
——	Scape clear orange brown; fore basitarsal plume long, distinct	*T. orientalis* n.sp.

16(13) Mid tibia with dark brown suffusions 17
—— Mid tibia clear orange-brown; hind tibia with fringe of long hair ..... *T. venustus*

17(16) Fore basitarsal plume present; lateral lobes S7 rounded (Figs 57–58) ..... *T. fuscus* n.sp.
—— Fore basitarsal plume absent; lateral lobes S7 triangular (Fig. 44) ..... *T. aeratus* n.sp.

18(1) Scape swollen, length < 3× width (Fig. 5) 19
—— Scape slender, length > 3× width (Fig. 6) 24

19(18) Apical flagellomere flattened and expanded (Fig. 7) ..... *T. dives* (Cockerell)
—— Apical flagellomere not flattened or expanded 20

20(19) Metasoma with inconspicuous metasomal bands 21
—— Metasoma with bright gold metasomal bands 22

21(20) Hair below antennae short, stiffly erect; base of clypeus bare ..... *T. latifrons*
—— Facial hair long, directed dorsally, covering clypeus almost completely ..... *T. burnsi*

22(20) Flagellum crenulate (Fig. 8); clypeal hair stiffly erect ..... *T. hackeri*
—— Flagellum normal; clypeal hair long, semi-erect 23

23(22) Supraclypeal area bare and polished ..... *T. chrysostomus*
—— Supraclypeal area densely punctate and pubescent ..... *T. sericeus*

24(18) Malar space almost twice as long as basal mandibular width ..... *T. macrognathus* n.sp.
—— Malar space shorter than basal mandibular width 25

25(24) Apical flagellomere expanded and truncate (Figs 7, 9) 26
—— Apical flagellomere not expanded and truncate 27

26(25) Metasoma orange-brown; hind tibia greatly expanded, without spurs ..... *T. pulcherrimus*
—— Metasoma black with white metasomal bands; hind legs normal ..... *T. gelasinus* n.sp.

27(25) Scape black ..... *T. aureotinctus*
—— Scape orange-brown or yellow-brown 28

28(27) Metasoma partly or entirely red-brown or orange-brown 29
—— Metasoma black with silver or gold metasomal bands 32

29(28) Metasoma entirely red-brown with indistinct bands ..... *T. erythrurus* (Cockerell)
—— Metasoma partly black, with silver or gold bands 30

30(29) Clypeus declivous, protruding only slightly ..... *T. simus* n.sp.
—— Clypeus strongly protuberant 31

31(30) S7 with step on posterior margin (Fig. 72); hind tibia orange ..... *T. rufibasis*
—— S7 without step on posterior margin (Fig. 76); hind tibia dark brown ..... *T. soror* n.sp.

32(28) Length 15–17 mm; S2 with dense, untidy plume ..... *T. marginatus* (Smith)
—— Length 10–14 mm; sternal pubescence weak 33

33(32) Flagellum 20% longer than head width; prementum length ≥ 3.5× eye width 34
—— Flagellum c. as long as head width; prementum length < 3.5× eye width 35

34(33) Fore basitarsus expanded ventrally ..... *T. multipectinatus* Houston
—— Fore basitarsus normal ..... *T. eremophilae* Houston

35(33) Fore trochanter with ventral projection 36
—— Fore trochanter without ventral projection 37

36(35) Metasomal bands silver; mid basitarsus slender, bowed longitudinally ..... *T. avialis* n.sp.
—— Metasomal bands gold; mid basitarsus broad, with stiff setae on anterior margin ..... *T. nitens* n.sp.

37(35) Pedicel, flagellum and scape concolorous ventrally ..... *T. centralis* n.sp.
—— Pedicel and flagellomere F1 ventrally, darker than scape 38

38(37) Metasomal bands wide, silver, margin ferruginous; clypeus flattened ..... *T. platyprosopis* n.sp.
—— Metasomal bands gold; clypeus convex 39

39(38) Clypeus black ..... *T. serotinus* n.sp.
—— Clypeus largely orange-brown 40

40(39) S7 with step on posterior margin (Fig. 72); hind tibia orange ..... *T. rufibasis*
—— S7 without step on posterior margin (Fig. 76); hind tibia dark brown ..... *T. soror* n.sp.

Key to females of the genus *Trichocolletes*

1 Eyes hairy 2
—— Eyes with minute setae only 18

2(1) Metasoma red-brown with indistinct gold bands ..... *T. brachytomus* n.sp.
—— Metastoma with distinct bands 3

3(2) Labrum dark brown or black, rarely with orange-brown suffusions 4
—— Labrum clear orange-brown, rarely with darker suffusions 9

4(2) Hind tarsal claw with small inner ramus 5
—— All claws simple 7

5(4) Labrum with medial tubercle ..... *T. tuberatus* n.sp.
—— Labrum uniformly convex 6

6(5) Clypeus with moderately small punctures and reticulate interspaces ..... *T. micans* n.sp.
—— Clypeus with coarse, almost contiguous punctures ..... *T. brunilabrum* n.sp.

7(4) Gena half as wide as eye; vertex not elevated (Figs 12–13) ..... *T. lacaris* n.sp.
—— Gena c. ⅔ as wide as eye; vertex elevated (Figs 10–11) 8

8(7) Scutal hair ferruginous, dense; clypeus flattened medially ..... *T. maximus* n.sp.
—— Scutal hair pale orange, close; clypeus uniformly convex ..... *T. grandis* n.sp.

9(3) Clypeus flattened sagittally 10
—— Clypeus transversely convex, not flattened 14

10(9) Pygidial plate with deep linear emargination ..... *T. dowerinensis*
—— Pygidial plate with at most small emargination 11

11(10) Metasomal integumental bands wide, brassy ..... *T. aeratus* n.sp.
—— Metasomal integumental bands narrow, silver 12

12(11) Length subantennal suture > ½ dorsal width clypeus ..... *T. capillosus* n.sp.
—— Length subantennal suture < ½ dorsal width clypeus 13

13(12) Lateral epistomal suture curved ..... *T. leucogenys* n.sp.
—— Lateral epistomal suture straight ..... *T. dundasensis* n.sp.

14(9) Malar space short (length c. 0.1× basal mandibular width) ..... *T. albigenae* n.sp.
—— Malar space > 0.2× basal mandibular width 15

15(14) Metasomal bands moderately wide, gold; basal suture of clypeus V-shaped ..... *T. venustus*
—— Metasomal bands narrow, silver or gold; basal suture of clypeus various 16

16(15) First flagellomere > 2× as long as medial width; clypeal suture concave ..... *T. tenuiculus*
—— First flagellomere < 2× as long as medial width; clypeal suture various 17

17(16) Metasomal bands gold; clypeal suture shallow V-shaped ..... *T. fuscus* n.sp.
—— Metasomal bands silver; clypeal suture straight ..... *T. orientalis* n.sp.

18(1) Metasomal bands silver, gold or white 19
—— Metasomal bands absent or indistinct 36

19(18) Facial hair brown, simple 20
—— Facial hair white or pale brown, plumose 21

20(19) Prepygidial fimbria black ..... *T. eremophilae*
—— Prepygidial fimbria orange ..... *T. multipectinatus*

21(19) Malar space ⅔ × basal mandibular width; scutal hair dark brown medially with contrasting pale perimeter ..... *T. macrognathus* n.sp.
—— Malar space ¼ × basal mandibular width or less; scutal hair uniformly coloured 22

22(21) Hind tarsal claw simple or with minute inner ramus (*Trichocolletes simus* n.sp.) 23
—— Hind tarsal claw with distinct inner ramus 27

23(22) Clypeus flat or declivous, not protuberant 24
—— Clypeus protuberant, transversely convex 25

24(23) Clypeus flattened, polished with broad irregular depressions ..... *T. platyprosopis* n.sp.
—— Clypeus deflexed near base, polished with close, regular punctures ..... *T. simus* n.sp.

25(23) Clypeus almost impunctate, apical half orange-brown ..... *T. dives*
—— Clypeus closely to densely punctate, mostly black 26

26(25) Narrow gold metasomal bands; prepygidial fimbria black; body length c. 15 mm ..... *T. marginatus*
—— Wide gold metasomal bands; prepygidial fimbria gold; body length c. 13 mm ..... *T. nitens* n.sp.

27(22) Metasoma partly or wholly red-brown 28
—— Metasoma black 29

28(27) Margin of pygidial plate with deep, narrow emargination ..... *T. soror* n.sp.
—— Margin of pygidial plate with at most a minute emargination ..... *T. rufibasis*

29(27) Supraclypeal area at distinct angle to clypeus 30
—— Supraclypeal area and clypeus nearly coplanar 31

30(29) Clypeus coarsely and densely punctate ..... *T. sericeus*
—— Clypeus openly punctate ..... *T. chrysostomus*

31(29) Labrum 0.75× as long as wide, tectiform (Fig. 15); metasomal bands white ..... *T. gelasinus* n.sp.
—— Labrum about half as long as wide, uniformly convex; metasomal bands gold 32

32(31) Scutal hair dark grey or grey-brown; labial palpus < 0.5× post palpal part of galea ..... *T. hackeri*
—— Scutal hair pale or mid-brown; labial palpus > 0.5× post palpal part of galea 33

33(32) Hind tarsal claw only with small inner ramus ..... *T. centralis* n.sp.
—— Hind tarsal claw with large inner ramus 34

34(33) Inner hind tibial spur with c. 7 teeth; body length c.15 mm ..... *T. luteorufus* n.sp.
—— Inner hind tibial spur with c. 10 teeth; body length c.12 mm 35

35(34) Metasomal bands pale gold or silver with broad ferruginous anterior margin ..... *T. aureotinctus*
—— Metasomal bands uniform gold ..... *T. serotinus* n.sp.

36(18) Metasoma orange-brown 37
—— Metasoma black 39

37(36) T2 without lateral black marks ..... *T. pulcherrimus*
—— T2 with black marks laterally 38

38(37) Impunctate area near antennal bases; tarsal claws simple ..... *T. erythrurus*
—— Face punctate near antennal bases; tarsal claws with large inner rami ..... *T. rufibasis*

39(36) T2–4 with white hair laterally; tarsal claws with large inner rami ..... *T. latifrons*
—— Metasoma without white hair; tarsal claws simple ..... *T. burnsi*

Species descriptions

Trichocolletes aeratus n.sp.

Figs 44, 80

Type. Holotype ♂, Bilpin, New South Wales (33.4814°S 150.5480°E), 21 Sep. 2005, M. Batley, *ex Daviesia mimosoides*, in AM K.278547.

Specimens examined. The holotype and the following. **Australian Capital Territory**: 3♂, Black Mountain (35.2633°S 149.0875°E), 1 Oct. 2006, M. Batley, *ex Daviesia mimosoides* & *Hardenbergia violacea*, AM (K.344635–37); Mount Ainslie, 21 Oct. 1993, G. J. Davis & G. V. Maynard, MV; Mount Ainslie, 21 Oct. 1993, G. J. Davis & G. V. Maynard, off *Helipterum*, MV. **New South Wales**: 4♂, Bilpin (33.4814°S 150.5480°E), 9–21 Sep. 2005 & 12 Sep. 2009, M. Batley, *ex Daviesia mimosoides*, AM (K.344632–33,41,42); ♂, 14 km E Coonabarrabran (31.2133°S 149.4022°E), 8 Oct. 2008, M. Batley, *ex Daviesia latifolia*, AM (K.344640); 2♂, ♀, Cunnawarra NP (30.5739°S 152.2583°E), 7 Oct. 2002, M. Batley, *ex Daviesia mimosoides* & *Podolobium ilicifolium*, AM (K.333629–31); 5♀, 30 km S Dubbo, 12 Nov. 1984, N. W. Rodd, AM (K.344634–38); ♂, Grose Vale, 11 Sep. 1978, N. W. Rodd, AM (K.316620); 13♂, 7♀, 1.5 km W Mongarlowe, 23 Oct. & 13 Nov. 1993, G. J. Davis & G. V. Maynard, off *Daviesia mimosoides*, MV (930958–62); 2♂, 12 km S Mount Canobolas (33.4208°S 148.9156°E), 2 Oct. 2008, M. Batley, *ex Pultenaea* sp., AM (K.344638–39); 4♀, Mt Victoria, 20 Oct. 1930, Burns, Alec N., MV (16533,34,46,47); 2♀, Mt Vincent, 20 Nov. 1978, N. W. Rodd, AM (K.316621–22); ♂, Mullion Flora Res. (33.1100°S 149.1700°E), 1 Oct. 2005, M. Batley, *ex Dillwynia* sp., AM (K.344634); ♂, Napoleon Reef (33.4172°S 149.7492°E), 7 Nov. 2005, M. Batley, *ex Daviesia leptophylla*, AM; 2♂, 2♀, Newnes, 24 Sep. 1972, G. Williams, AM (K.316616–19); 4♂, 3♀, Weddin Mtns NP, 24 Sep. 1980, N. W. Rodd, AM (K.316623–29); 2♀, Wentworth Falls, Oct. 1930, Wilson, F E., MV (16501–02). **Queensland**: ♀, Acacia Ridge, 14 Aug. 1966, I. D. Galloway, UQIC; ♂, S of Amiens, 27 Sep. 1967, T. F. Houston, *Daviesia*, SAM (32-024504); ♂, 3♀, Beechmont, 2–5 Oct. 1984, N. W. Rodd, AM (K.316630–33); 6♂, Brisbane, 28 Aug.–4 Sep. 1911, H. Hacker, QM; 3♂, Brisbane, 18 Aug. 1914, H. Hacker, QM; ♀, Brisbane, 8 Sep. 1915, H. Hacker, QM; 2♀, Dunwich, Nth Stradbroke Is, 22 Aug. 1958, F. A. Perkins, UQIC; 2♂, S of Eukey, 26 Sep. 1967, T. F. Houston, *Daviesia* and *Hardenbergia*, SAM (32-024502, 06); 2♀, Kelvin Grove, 14 Sep. 1912, on *Daviesia*, QM; ♂, ♀, Mt Cooth-Tha, 14 Sep.–19 Oct. 1966, T. F. Houston, SAM (32-024494,500); ♂, Mt Marley nr Stanthorpe, 22 Sep. 1995, D. K. Yeates, at *Hardenbergia violacea* blossom, UQIC; ♂, Stanthorpe, 4 Oct. 1966, J. C. Cardale, UQIC; ♀, Sunnybank, 25 Sep. 1911, H. Hacker, QM; 2♂, ♀, Tooheys Hill, 28 Aug.–4 Sep. 1911, H. Hacker, QM.

Diagnosis

Length 10–11 mm; eyes hairy; metasomal bands wide, brassy colour; male fore basitarsus without plume; female clypeus sagittaly flattened.

Descriptions

Male (holotype).—*Head* width 3.60 mm, body length 10.1 mm. HW 50, HL 40, UID 31, UFW 32, LID 31, DMA 31, HVO 4, WOC 14, MOD 4, OOD 9, IAD 10, ASD 3, AOD 8, ML 22, BMW 3, MSL 7.5, SL 14, SW 3, FL c. 54.—*Eyes* hairy; inner orbits parallel; length malar space c. 0.33× basal mandibular width; middle flagellomeres c.1.4× as long as wide. Hind tarsus 1.2× as long as hind tibia; hind basitarsus 5.0× as long as wide. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with broad, rounded lateral lobes and short posterior projections (Fig. 44).—*Labrum*, mandible, scape, tarsi, tibiae and apices of femora orange-brown; fore and mid tibiae with dark suffusions medially. T1–5 with wide, brassy bands.—*Clypeus* with contiguous punctures except at ventral margin. Scutum with dull sheen, moderate pit-reticulation and close, small punctures.—*Face* with dense, long, orange hair, finely branched below antennae, plumose above. Scutum with close, long, plumose, bright orange hair, semi-adpressed hair on metasomal terga somewhat longer than in most other species; dark areas of metasomal terga with scattered, short, golden hair.

Female (AM K.316623).—*Head* width 4.05 mm, body length 11.0 mm. HW 50, HL 39, UID 29, UFW 32, LID 32, DMA 32, HVO 3, WOC 13, MOD 3, OOD 8, IAD 8, ASD 3, AOD 10, ML 21, BMW 8, MSL 1.5, SL 15, SW 3, FL c. 34.—*Eyes* hairy; inner orbits slightly divergent ventrally; length malar space c. 0.25× basal mandibular width; clypeus convex, sagittally flattened; basal suture gently concave; middle flagellomeres 1.1× as long as wide; inner hind tibial spur with c. 8 strong teeth; tarsal claws simple; pygidial plate with small apical emargination, strong medial elevation and strongly upturned rim.—*Labrum*, tarsi, hind tibia, anterior face fore tibia, distal ends femora orange-brown; mandible medially, flagellum ventrally, brown. T1–4 with wide, metallic, yellow-gold bands.—*Clypeus* reticulate with dense, large, irregular punctures, becoming open ventrally. Scutal sculpture as for male.—*Face* with long, minutely-branched, pale orange hair, dense on frons and in paraocular areas, open on clypeus and supraclypeal area. Scutum with close, short, plumose, dull orange-brown hair; hind tibial scopa chestnut (dark brown in basitibial area); prepygidial fimbria dull golden brown.

Etymology. The specific name is from the Latin adjective meaning trimmed with brass.

Distribution. Southeastern Queensland, New South Wales central slopes and tablelands (BBS, NET, NSS, SB, SEH, SEQ) (Fig. 80).

Trichocolletes albigenae n.sp.

Figs 45, 81

Type. Holotype ♂, Doyles Creek, New South Wales (32.5219°S 150.7972°E), 22 Aug. 2005, M. Batley, *ex Daviesia genistifolia*, in AM K.278548.

Specimens examined. The holotype and the following. **New South Wales**: 13♂, 2♀, Doyles Creek (32.5219°S 150.7972°E), 19–22 Aug. 2005 & 16 Aug. 2006, M. Batley, *ex Daviesia genistifolia*, AM (K.224639, K.344643–58); 2♀, Doyles Creek (32.5236°S 150.7961°E), 28 Aug. 2006, M. Batley, *ex Daviesia genistifolia*, AM (K.344659–60); ♂, ♀, Pulletop NR (33.9656°S 146.0842°E), 1 Sep. 2009, M. Batley, *ex Templetonia sulcata*, AM (K.344665–66); ♀, Pulletop NR (33.9656°S 146.0842°E), 26 Sep. 2010, M. Batley, *ex Daviesia genistifolia*, AM (K.344667); 2♂, 24 km SE Wollar (32.5547°S 150.0119°E), 28 Aug. 2006, M. Batley, *ex Daviesia genistifolia*, AM (K.344661–62). **South Australia**: 2♀, Pinnaroo (35.5539°S 140.7614°E) 7 Oct. 2003, M. Batley *ex Dillwynia* sp. (AM K.334628, 43).

Diagnosis

Length c. 11 mm; eyes hairy; metasomal bands narrow, silver; genal hair dense, white (less conspicuous in females). Clypeus of both sexes shallowly convex; malar space of female short.

Descriptions

Male (holotype).—*Head* width 3.60 mm, body length 11.1 mm. Relative dimensions: HW 50, HL 39, UID 32, UFW 33, LID 29, DMA 28, HVO 5, WOC 13, MOD 4, OOD 10, IAD 10, ASD 3, AOD 7, ML 19, BMW 7, MSL 1.0, SL 13, SW 3, FL c. 42.—*Eyes* hairy; face narrow, inner orbits convergent ventrally; malar space relatively short (length c. 0.15× basal mandibular width); gena 0.55× as wide as eye viewed laterally; flagellum shorter than head width; middle flagellomeres c. 1.4× as long as wide. Legs slender; hind tarsus 1.2× as long as hind tibia; hind basitarsus 4.3× as long as wide; posterior carina of basitibial area reaches apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with rectangular lateral lobes, large basal teeth and posterior projections (Fig. 45).—*Labrum*, mandible, scape, tarsi, tibiae and distal ends of femora orange-brown, fore and mid tibiae with darker areas medially; flagellum dark brown dorsally; F2–11 orange-brown ventrally. T1–5 with narrow silver bands stained feruginous across anterior margin.—*Clypeus* with dense, fine punctures except near ventral rim. Scutum with dull sheen, reticulate with close, small punctures.—*Face* with dense, pale orange, plumose hair; gena with very dense, plumose, white hair. Scutum with open, long, finely-branched, pale orange-brown hair; fore basitarus with relatively short, tapered plume; anterior margin of hind tibia with open fringe of long, white hair.

Female (AM K.344659).—*Head* width 4.20 mm, body length 12.0 mm. Relative dimensions: HW 50, HL 37, UID 31, UFW 32, LID 31, DMA 31, HVO 29, WOC 4, MOD 13, OOD 4, IAD 8, ASD 3, AOD 8, ML 19, BMW 8, MSL 1.0, SL 15, SW 3, FL c. 30.—*Eyes* hairy; face slightly broader than long, inner orbits gently convergent ventrally; length malar space c. 0.1× basal mandibular width; clypeus shallowly convex, slightly flattened sagittally; gena 0.55× as wide as eye viewed laterally; flagellum short, middle flagellomeres approximately as wide as long; inner hind tibial spur with c. 11 strong teeth; tarsal claws simple; pygidial plate entire, flat.—*Labrum*, mandible, tarsi (except mid basitarsus), hind tibia, distal ends of femora orange-brown; remainder of legs dark brown. T1–4 with narrow silver bands, weakly ferruginous across anterior margin.—*Clypeus* reticulate except along ventral margin, densely punctate. Scutal sculpture as for male.—*Face* with long, plumose hair, white in lower paraocular areas, becoming orange-brown tipped with dark brown near ocelli, dense in paraocular areas and on frons, open on clypeus and supraclypeal area; gena with close, plumose white hair. Scutum with close, plumose, dark-tipped pale orange hair; hind tibial scopa orange-brown laterally, darker medially; prepygidial fimbria dark brown.

Etymology. The specific name, used as a noun in apposition, is from the Latin for white cheeks.

Distribution. Central New South Wales (CP, SB) (Fig. 81).

Trichocolletes aureotinctus (Cockerell)

Figs 29, 46, 82

Anthoglossa aureotincta Cockerell, 1906, p. 16 (female).
Trichocolletes (Trichocolletes) aureotinctus.—Michener, 1965, p. 79.

Specimens examined. The holotype ♀, Perth, W. Australia, 93-198, Anthophora aurotincta (handwritten label, presumably in error), BMNH Hym 17.a.397 and the following. **Western Australia**: 2♂, 12.5 km ENE Anketell, 6–7 Sep. 1981, T.F Houston, on flowers of *Baeckea stowardii*, WAM (13647, 19124); ♀, 34 km ENE Cosmo Newberry Mission, 12 Sep. 1982, B. Hanich & T. F. Houston, on flowers of *Swainsona*, WAM (13836); 4♂, 11♀, 37 km NE Laverton, 10–12 Sep. 1982, B. Hanich & T. F. Houston, on flowers of *Kennedia nematoclada* & *Daviesia aff. grahami*, WAM (13824–34, 13641–44); ♀, 32 km N Mingenew, 14 Sep. 1987, T. F. Houston, on flowers of *Dampiera*, WAM (13562); 2♂, 30 km W Sandstone, 7 Sep. 1981, T.F Houston, on flowers of *Daviesia grahami*, WAM (13645–46).

Diagnosis

Eyes not hairy; metasomal bands moderately broad, silver or pale gold, ferruginous across anterior margins; metasoma

sericeus. Male scape black; mid basitarsus broadened distally. Female with large inner ramus on tarsal claws.

Descriptions

Male (WAM 13642).—*Head* width 3.7 mm, body length 10.1 mm. Relative dimensions: HW 50, HL 36, UID 33, UFW 31, LID 28, DMA 26, HVO 4, WOC 13, MOD 4, OOD 9, ML 15, BMW 6.5, MSL 1, SL 13, SW 3, FL c. 50.—*Eyes* not hairy; inner orbits convergent ventrally; malar space short (length c. 0.15× basal mandibular width); length flagellum equal to head width; middle flagellomeres c. 1.5× as long as wide. Legs slender; hind tarsus 1.3× as long as tibia; length basitarsus 6.0× as long as wide; basitibial area with distinct posterior edge almost reaching apex. Gonoforceps with hair of moderate length (Fig. 29); S7 with broad lateral lobes fused to ligulate processes subsuming basal teeth, posterior projections absent (Fig. 46).—*Mandible* medially amber; labrum, tibiae, tarsi and distal ends of femora orange-brown, fore and mid tibiae with dark infuscations; flagellum ventrally mid-brown; ventral rim clypeus, flagellum dorsally dark brown. T1–5 with broad silver or pale gold bands, ferruginous across anterior margins; T7 red-brown.—*Clypeus* reticulate with dense, large punctures except apically impunctate and polished. Scutum dull with strong pit-reticulation and indistinct, open punctures.—*Face* with long, plumose, white hair, gena with white hair forming a beard; scutum with open, long, finely-branched, white hair; fore coxa, trochanter and tibia with long white hair; remainder of legs with sparse hair only.

Female (WAM 13831).—*Head* width 4.05 mm, body length 11.7 mm. Relative dimensions: HW 50, HL 35, UID 32, UFW 33, LID 30, DMA 28, HVO 3, WOC 15, MOD 4, OOD 8, IAD 6.5, ASD 3, AOD 9, ML 18, BMW 5.5, MSL 1, SL 15, SW 2.5, FL c. 28.—*Eyes* not hairy; face almost quadrate, inner orbits slightly convergent ventrally; malar space short (length c. 0.15× basal mandibular width); clypeus smoothly convex; middle flagellomeres as long as wide; inner hind tibial spur with c. 10 long, closely-spaced teeth; pygidial plate minutely emarginate, medial elevation broad.—*Labrum*, mandible medially, ventral margin of clypeus, anterior faces fore tibia and tarsus orange-brown; remainder of legs brown. T1–4 with broad, pale gold or silver bands, broadly ferruginous across anterior margin.—*Clypeus* reticulate with large, dense punctures except ventral margin impunctate and polished; supraclypeal area with large, close to dense punctures; frontal carina ending in sharp point on supraclypeal area. Sculpture of scutum as for male.—*Face* with long, plumose hair; dense, white on apicolateral corners of clypeus and in paraocular areas; sparse on supraclypeal area and remainder of clypeus; dense, pale orange-brown on frons and vertex. Scutum with open, long, orange-brown hair; hind tibial scopal hair white except rich brown near basitibial area. T2–5 sericeous with simple, semi-adpressed, amber hair; prepygidial fimbria golden-brown.

Remarks. The male has not previously been described. Only the holotype is recorded from as far south as Perth. Given the age of the specimen, the location may be approximate. This species is referred to as F246 and M225 in Houston (2000).

Distribution. Western Australia east of Geraldton (GS, GVD, MUR, SWA?) (Fig. 82).

Trichocolletes avialis n.sp.

Figs 47, 83

Type. Holotype ♂, 20m E Mt Madley, Western Australia, 7 Sep. 1971, in WAM 13797

Specimens examined. The holotype and the following. **Northern Territory**: ♂, 41 Mile Bore, 10 Jul. 1989, N. W. Rodd, AM (K.316639).

Diagnosis

Male (female unknown) eyes not hairy; metasomal bands silver; flagellum largely orange; mid basitarsus bowed; fore trochanter with spine.

Description

Male (holotype).—*Head* width 3.65 mm, body length 12.6 mm. Relative dimensions: HW 50, HL 36, UID 31, UFW 32, LID 32, DMA 33, HVO 4, WOC 15, MOD 4, OOD 8, IAD 9, ASD 3, AOD 9, ML 20, BMW 7, MSL 0.3, SL 12, SW 3, FL c. 43.—*Eyes* not hairy; face narrow; inner orbits divergent ventrally; malar space short (length c. 0.1× basal mandibular width); middle flagellomeres c. 1.3× as long as wide. Legs slender; fore trochanter with ventrally-directed spine; proximal end of mid basitarsus strongly bowed longitudinally; hind tarsus as long as hind tibia; hind basitarsus 4.1× as long as wide; hind basitibial area with pigmented posterior carina reaching apex. Gonoforceps with long, dense hair, otherwise genital capsule like that for *T. orientalis* n.sp. (Fig. 37); S7 (K.316639) with broad, rectangular lateral lobes, lateral edges emarginate, posterior projections, basal teeth and ligulate processes long and thin (Fig. 47).—*Labrum*, ventral 25% clypeus cream; mandible basally pale amber; scape, femora, tibiae, fore tarsus, distal half trochanters, most of flagellum orange-brown; flagellomeres F3–10 dorsally, mid and hind tarsi dark brown. T1–5 with moderately broad silver bands; apex of T7 orange-brown.—*Scutum* shining, closely punctate.—*Face* with dense, finely-branched, bright orange hair, stiffly erect on clypeus; gena with golden hair forming a beard. Scutum with close, long, plumose, orange hair; fore basitarsus with plume of pale gold hair; hind femur openly covered with moderate length, apically-directed, pale orange hair.

Etymology. The specific name is from the Latin adjective meaning out-of-way or off road, referring to the remote collection sites for the two known specimens.

Distribution. Arid areas in northern half of Australia (DMR, LSD) (Fig. 83).

Trichocolletes brachytomus n.sp.

Figs 21, 25, 48, 84

Type. Holotype ♂, Orroroo, South Australia, 24 Dec. 1938, in ANIC.

Specimens examined. The holotype and the following. **New South Wales**: ♂, Kinchega NP (32.4581°S 142.3525°E), 8 Sep. 2007, M. Batley, AM (K.278549). **South Australia**: ♀, Flinders Rg, 1 Sep. 1948, Hall, SAM (32-024542); ♀, Lake Eyre N Sulphur Pen., 1 Aug. 1967, G. Gross, SAM (32-024543); ♀, nr Lake Harry NE Maree, 24 Sep. 1972, H. Mincham, SAM (32-024532); 2♀, Orroroo, 2 Oct. 1937, J.T. Gray, AM (K.316640–41); ♀, same data, SAM (32-024540); 3♂, 3♀, Orroroo, 23 Sep. 1938, J.T. Gray,

SAM (32-024533–40); ♀, Orroroo, 1 Dec. 1938, ANIC; 4♀, data as for holotype; ♂, Orroroo, 14 Jan. 1939, ANIC; 2♂, 3♀, Orroroo, 3 Mar. 1939, ANIC; 2♀, Rev A. P. Burgess, SAM (32-024539,41).

Diagnosis

Eyes hairy; metasoma red with indistinct bands; T2 without dark marks laterally. Male scape and labrum black; hair on supraclypeal area shorter than on surrounding areas.

Descriptions

Male (holotype).—*Head* width 4.20 mm, body length 12.0 mm. Relative dimensions: HW 50, HL 37, UID 31, UFW 32, LID 29, DMA 29, HVO 4, WOC 14, MOD 4, OOD 9, IAD 10, ASD 3, AOD 8, ML 19, BMW 6, MSL 1.5, SL 13, SW 3, FL c. 51.—Eyes hairy; face broad, eyes slightly convergent ventrally; length malar space c. 0.3× basal mandibular width; length flagellum equal to head width, middle flagellomeres c. 1.5× as long as wide. Legs robust; inner faces of fore and mid tibiae with angular ridge on distal half; fore basitarsus strongly broadened near calcar; hind tarsus 1.1× as long as hind tibia; hind basitarsus 3.8× as long as wide; basitibial area carinate and elevated above surroundings, carina reduced to angular edge on proximal 40% of anterior margin (Fig. 25). Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 (K.278549) posterior projections short and blunt, lateral lobes tapered with posterior margin crenulate (Fig. 48).—Head and mesosoma black except flagellomeres F2–8 yellow-brown ventrally, distitarsi orange-brown. Metasoma red, bands indistinct but occasionally with ill-defined gold reflections.—*Clypeus* with contiguous punctures except apical margin impunctate; scutum with dull sheen, moderate pit-reticulation and close, fine punctures.—*Face* with finely-branched, white hair, long, dense in paraocular areas, on frons and basal half clypeus; shorter, dense and stiffly erect on supraclypeal area. Scutum with close, long, plumose, very pale orange hair; fore basitarsus with plume; anterior margin of hind tibia with open fringe of long, white hair; metasomal terga sericeus with open, semi-adpressed, pale golden hair.

Female (AM K.316640).—*Head* width 4.45 mm, body length 13.0 mm. HW 50, HL 34, UID 30, UFW 32, LID 30, DMA 32, HVO 4, WOC 13, MOD 3, OOD 9, IAD 9, ASD 3, AOD 9, ML 17, BMW 7.5, MSL 1.5, SL 15.5, SW 2, FL c. 33.—*Eyes* hairy; face broad, inner orbits parallel; malar space short (length c. 0.2× basal mandibular width); clypeus convex, basal half flattened sagittally; middle flagellomeres as long as wide; inner hind tibial spur with c. 8 long teeth; basitibial area elevated above surrounding surfaces, posterior margin with thickened ridge forming an irregular edge (Fig. 21); hind tarsal claw small inner ramus; pygidial plate entire with strong medial elevation.—Integument of head and mesosoma black except labrum amber; legs dark orange-brown; mandible medially, flagellum ventrally dark brown. Metasoma red with indistinct, narrow, gold bands; T2 without dark lateral marks.—*Clypeus* dull with weak pit-reticulation and close punctures, except near apical margin; supraclypeal area with smaller, dense punctures; scutum dull with moderately strong pit-reticulation and dense punctures.—*Face* with long, white hair, becoming pale orange towards ocelli, dense in paraocular areas and on frons, sparse on clypeus. Scutum with dense, minutely-branched, bright orange hair; hind tibial scopa pale orange; prepygidial fimbria orange.

Etymology. The specific name is from the Latin adjective meaning clipped, referring to the hair on the supraclypeal area of the male.

Distribution. South Australia and far western New South Wales (DRP, FLB, SSD, STP) (Fig. 84).

Trichocolletes brunilabrum n.sp.

Figs 49, 85

Type. Holotype ♂, 7 km N Wongawol HS, Western Australia, 29–30 Jul. 1983, T. F. Houston & R. P. McMillan, on flowers of *Swainsona*, in WAM 13651.

Specimens examined. The holotype and the following. **Western Australia**: 3♂, same data as holotype WAM (13648–50); ♀, Belele, A. Snell, WAM (19118); 2♀, Belele, WAM (13710–11); 3♀, Boolathana Station (24.53°S 113.78°E), 29 May–25 Aug. 1995, N. Hall, WAM (22207–08, 21024); ♀, Bush Bay (25.06°S 113.70°E), 23 May–23 Aug. 1995, N. Hall, WAM (21025); ♀, 37 km SW Glenayle HS, 6–9 Aug. 1983, T. F. Houston & R. P. McMillan, on flowers of *Swainsona*, WAM (13652); ♀, 13 km WSW Hamelin, 23 Aug. 1980, T. F. Houston, on flowers of *Swainsona*, WAM (13989); 3♀, 30 km NW Lorna Glen HS, 10 Aug. 1983, T. F. Houston & R. P. McMillan, on *Indigofera georgei*, WAM (13653–55); 3♀, 31 km ESE Minnie Creek HS, 2 Sep. 1980, C. A. Howard & T. F. Houston, on flowers of *Swainsona*, WAM (13984–86).

Diagnosis

Length c. 11 mm; eyes hairy; scape black in both sexes; legs black; metasoma sericeous with moderately wide, silver bands, narrowly ferruginous across anterior margins; labrum without a tubercle; known only from western Australia. Male fore basitarsus with short hair only; S7 with narrow, rectangular lateral lobes. Female clypeus coarsely sculptured; hind tarsal claw with inner ramus.

Descriptions

Male (holotype).—*Head* width 3.60 mm, body length 11.1 mm. Relative dimensions: HW 50, HL 37, UID 30, UFW 31, LID 29, DMA 28, HVO 4, WOC 14, MOD 4, OOD 8, IAD 8, ASD 3, AOD 7, ML 17, BMW 7, MSL 2.5, SL 15, SW 3, FL c. 52.—*Eyes* hairy, length malar space c. 0.25× basal mandibular width; length flagellum equal to head width, all flagellomeres longer than wide; hind tarsus 0.9× as long as hind tibia; hind basitarsus 4.4× as long as wide; posterior carina of basitibial area extends well beyond apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with thin, rectangular lateral lobes and large basal teeth (Fig. 49).—*Labrum* amber with black suffusions; mandible medially amber; flagellum dark brown, paler ventrally; distitarsi apically orange-brown. T1–5 with broad, silver bands.—*Clypeus* coarsely punctate, with moderately large, coalescent punctures and irregular, narrow interspaces; scutum with dull sheen, moderately strong pit-reticulation and close small punctures.—*Face* with dense, long, white hair. Scutum with close, long, finely-branched pale brown hair; fore basitarsus without distinct plume; hind femur with open fringe long white hair on anterior margin.

Female (WAM13653).—*Head* width 3.90 mm, body length 11.6 mm. Relative dimensions: HW 50, HL 37, UID 29, UFW 32, LID 35, DMA 30, HVO 3, WOC 15, MOD 4,

OOD 8, IAD 7, ASD 3, AOD 9, ML 15, BMW 8, MSL 2.0, SL 15, SW 3, FL c. 29.—*Eyes* hairy; length malar space c. 0.15× basal mandibular width; clypeus gently convex, basal suture shallowly V-shaped; middle flagellomeres c. 1.1× as long as wide; inner hind tibial spur with c. 8 long teeth; hind tarsal claw with distinct, sharp inner ramus, mid tarsal claw with minute inner ramus, fore tarsal claw simple; pygidial plate with medial elevation and small emargination.—*Labrum*, mandible medially dark brown; distitarsi apically orange-brown. T1–4 with wide silver bands, narrowly ferruginous across anterior margins.—*Clypeus* strongly reticulate, coarsely punctate with large dense punctures partially coalescent. Scutum dull with strong pit-reticulation obscuring punctures.—*Face* with long white plumose hair, becoming pale brown hair near ocelli, dense in paraocular areas and on frons, sparse on clypeus and supraclypeal area. Scutum with close, plumose, pale orange-brown hair; tibial scopa brown medially, white laterally; prepygidial fimbria pale brown.

Remarks. The sexes were associated by morphological similarity and geographic distribution only. This species is referred to as F267 in Houston (2000).

Distribution. Predominantly east from Shark Bay, Western Australia, with one record from near Perth (CAR, GAS, MUR, SWA) (Fig. 85).

Trichocolletes burnsi Michener

Figs 30, 50, 86

Trichocolletes (Trichocolletes) burnsi Michener, 1965, p. 263 (female).

Specimens examined. The holotype ♀, Wentworth Falls, NSW, 7 Oct. 1930, A. N. Burns, MV (T–6265) and the following. **Australian Capital Territory**: ♂, Picadilly Circus, Brindabella Range, 24 Nov. 1981, J. C. Cardale, ANIC; ♂, Picadilly Circus, Brindabella Range, 2 Jan. 1986, D.C.F. Rendz, ANIC. **New South Wales**: ♀, 7 km NE Bilpin, 25 Oct. 1977, N. W. Rodd, AM (K.316653); 2♀, Bilpin, 9 Oct. 1978, N. W. Rodd, AM (K.316655–56); ♂, Clarence, 4 Oct. 1988, N. W. Rodd, AM (K.316662); ♀, Cunnawarra NP (30.5283°S 152.3133°E), 11 Nov. 2003, M. Batley, AM (K.316496); ♂, Gibraltar Range NP (29.5528°S 152.2531°E), 20 Sep. 2000, M. Batley, AM (K.316497); 2♀, Haystack Ridge, 19 Oct. 1977, N. W. Rodd, AM (K.316651–52); ♀, Haystack Ridge, 7 Nov. 1977, N. W. Rodd, AM (K.316654); ♂, Kosciusco, 24 Nov. 1921, R. J. Tillyard, QM; 4♂, 3♀, Mt Tomah, 10 Oct. 1977, N. W. Rodd, AM (K.316642–48); ♂, ♀, Mt Tomah, 11 Oct. 1977, N. W. Rodd, AM (K.316649–50); 4♂, ♀, 3 km S Mt Wilson, 8 Oct. 1979, N. W. Rodd, AM (K.316657–61); ♂, Mount Wilson (33.5417°S 150.3414°E), 24 Sep. 2002, M. Batley, AM (K.316498); 2♀, Mount Wilson (33.5417°S 150.3414°E), 20 Oct. 2002, M. Batley, AM (K.316500–01); ♂, Narrow Neck (33.7492°S 150.2800°E), 27 Sep. 2002, M. Batley, AM (K.316499); ♂, Wentworth Falls, 27 Oct. 1930, Burns, Alec N., MV(16561). **Victoria**: ♂, The Grampians 23 Oct. 1932, Burns, Alec N., MV(16529); ♂, Mirimbah, 12 Nov. 1957, Neboiss, Arturs, MV(16496).

Diagnosis

Length 12–14 mm; eyes not hairy; metasomal bands indistinct; clypeus short. Male hair on clypeus and supraclypeal area dorsally directed; mid basitarsus bowed; ventral surface of hind femur without hair. Female tarsal claws simple; metasomal terga without white hair.

Descriptions

Male (AM K.316499), not previously described.—*Head* width 4.3 mm, body length 12.8 mm. Relative dimensions: HW 50, HL 33, UID 29, UFW 31, LID 36, DMA 32, HVO 4, WOC 11, MOD 4, OOD 9, IAD 11, ASD 3, AOD 7, ML 21, BMW 7, MSL 3.5, SL 12, SW 4, FL c. 57.—*Eyes* not hairy; face broad, inner orbits strongly divergent ventrally; scapes slightly swollen (width 0.35× length); length malar space c. 0.7× basal width mandible; clypeus short (length 0.35× as long as wide); labrum uniformly convex with slight longitudinal depression medially; middle flagellomeres 1.8× as long as wide. Legs slender; distitarsi rather broad; mid basitarsus slightly bowed and twisted distally; hind tarsus 1.2× as long as hind tibia; length basitarsus 4.9× as long as wide; basitibial area with posterior carina reaching apex. Gonoforceps with long hair (Fig. 30) as in *T. orientalis* n.sp.; S7 with very broad, rectangular lateral lobes and short posterior projections (Fig. 50).—*Labrum*, mandible basally, ventral rim of clypeus, cream; tibiae, tarsi, scape, flagellomeres F1–7 ventrally and half F1 dorsally, orange-brown; trochanters and femora dark brown suffused with variable amounts of orange-brown. T1–6 and S1 with apical margins indistinctly dark brown.—*Clypeus* with dense, small punctures except narrow basal margin impunctate. Scutum dull with weak pit-reticulation.—*Face* with dense, finely-branched, bright orange hair, stiff and obliquely vertically directed on clypeus and supraclypeal area; vertex with tuft of long orange hair behind ocelli; lower gena with dense beard of long white hair. Scutum with close, long, finely-branched, orange hair; fore basitarsus with fringe of finely-branched white hair. T1,2 with sparse cover of long, erect, finely-branched white hair; remaining terga with simple, semi-erect hair matching underlying integument.

Female (AM K.316500).—*Head* width 4.55 mm, body length 13.1 mm. Relative dimensions: HW 50, HL 36, UID 27, UFW 31, LID 36, DMA 32, HVO 4, WOC 12, MOD 4, OOD 8, IAD 8, ASD 3, AOD 10, ML 23, BMW 8, MSL 4.5, SL 15, SW 2, FL c. 34.—*Eyes* not hairy; face broad, inner orbits strongly divergent ventrally; malar space c. 0.6× basal width mandible; clypeus short (length 0.45× as long as wide), uniformly convex transversely; middle flagellomeres c. 1.2× as long as wide; inner hind tibial spur with c. 9 teeth; tarsal claws simple; pygidial plate with strong medial elevation.—*Labrum* and mandibles brown; legs dark brown with orange-brown suffusions on fore and mid femora, tibiae and all distitarsi.—*Clypeus* weakly reticulate with open punctures becoming close towards lateral margins. Apical margins T1–4 smoother than remainder of terga.—*Face* with dense, long, plumose white hair becoming dark brown near vertex. Scutum with dense, short, plumose, dark brown hair; pre-pygidial fimbria dark-brown or black.

Remarks. Similar to *T. latifrons* from which male may be distinguished clypeal hair, mid basitarsus and absence of hair from ventral surface of hind femur. Females may distinguished from *T. latifrons* by the tarsal claws and absence of white hair from metasomal terga.

Distribution. Montane areas of eastern Australia from southern Queensland to Victoria (AA, NET, SB, SEH, VM) (Fig. 86).

Figs 3–4. *Trichocolletes capillosus* n.sp., male: (3) left fore tarsus (arrow indicates setose projection) (4) ventral view of mid and hind legs showing long hair on femora (arrowed).

Trichocolletes capillosus n.sp.

Figs 3–4, 51, 87

Type. Holotype ♂, Coomberdale, Western Australia, 9 Jul. 1976, R. P. McMillan, in WAM 13792.

Specimens examined. The holotype and the following. **Western Australia**: 2♂, same data as holotype, WAM (13793–94); 3♂, Bolgart, 12 Nov. 1950, ANIC; ♀, 30 km E Cramphorne (31.7939°S 118.8731°E), 20 Oct. 2009, M. Batley, AM (K.344667); ♂, 14 km NW Narrogin (32.8761°S 117.0425°E), 9 Oct. 2009, M. Batley, *ex Gastrolobium crassifolium*, AM (K.278550); ♂, Nabawa, 9 Jul. 1998, S. R. Patterson, WAM (21393); ♂, 11 mi N of New Norcia, 18 Aug. 1971, T. F. Houston, on *Daviesia* & *Pultenaea*, SAM (32-024670); ♂, Stathams, WAM (13713); ♂, Wamenusking, WAM (13700); ♀, 15 km N Westonia (31.1981°S 118.7586°E), 19 Sep. 2004, M. Batley, *ex Gastrolobium* sp. AM (K.344666).

Diagnosis

Eyes hairy; metasomal bands narrow, silver. Male mid and hind femora with very long, dense hair (Fig. 4). Female upper margin of clypeus narrow.

Descriptions

Male (AM K.278550).—*Head* width 3.75 mm, body length 11.5 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 31, LID 31, WOC 14, MOD 4, OOD 9, IAD 9, ASD 4, AOD 7, ML 20, BMW 7, MSL 3.0, SL 13, SW 3, FL c. 53.—*Eyes* hairy; face approximately quadrate, inner orbits parallel; length malar space c. 0.45× basal mandibular width; flagellum longer than head width, middle flagellomeres c. 1.4× as long as wide. Legs slender; fore basitarsus noticeably short, abruptly thicker at distal end, which bears a tuft of setae on inner margin (Fig. 3); hind tarsus as long as hind tibia; hind basitarsus 4.7× as long as wide; posterior carina of basitibial area reaches apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 relatively glabrescent, triangular lateral lobes fused with short ligulate process, subsuming basal teeth, posterior projections virtually obsolete (Fig. 51).—*Labrum*, mandible medially, scape, tarsi, tibiae, distal ends femora orange-brown, except fore basitarsus cream or pale orange-brown; flagellomeres F2–8 yellow-brown ventrally; remainder of flagellum dark brown. T1–5 with narrow silver bands; T7 dark orange-brown. Wings noticeably darkened.—*Scutum* with dull sheen, moderate pit-reticulation and close, small punctures.—*Face* with dense, long, finely-branched, orange hair. Scutum with close, long, plumose, orange hair; fore basitarsus with plume of long orange hair on proximal half (Fig. 3); mid and hind femora with unusually long, dense, orange hair (Fig. 4).

Female (AM K.344667).—*Head* width 4.05 mm, body length 11.7 mm. Relative dimensions: HW 50, HL 39, UID 29, UFW 32, LID 32, WOC 13, MOD 3, OOD 8, IAD 8, ASD 4, AOD 9, ML 21, BMW 7, MSL 2.0, SL 16, SW 3, FL c. 31.—*Eyes* hairy; face slightly wider than longer, inner orbits parallel; malar space moderately long (length c. 0.4× basal mandibular width); clypeus convex, sagittally flattened, basal suture V-shaped; basal width clypeus < 2× length subantennal suture; middle flagellomeres c. 1.1.× as long as wide; hind tibial spur with c. 7 long teeth; tarsal claws simple; pygidial plate emarginate with low medial elevation.—*Labrum*, mandible, tarsi, hind tibiae, apices femora orange-brown, with dark brown medially on fore and mid tibiae; flagellomers F2–10 yellow-brown ventrally; remainder of flagellum dark brown. T1–4 with narrow silver bands. Wings darkened.—*Clypeus* weakly reticulate basally with dense medium punctures medially, sparse laterally, apico-lateral corners with dense, fine punctures. Scutal sculpture as for male.—*Face* with long, plumose, pale hair, dark-tipped near ocelli, dense in paraocular areas and on frons, sparse on clypeus and supraclypeal area. Scutum with close, plumose, dark-tipped pale brown hair; scopal hair orange-brown laterally, darker medially; pre-pygidial fimbria dark brown.

Remarks. Sexes associated by morphological similarity and mitochondrial cytochrome oxidase subunit I DNA sequence (results not shown). This species is referred to as M242 in Houston (2000). Females resemble those of *T. leucogenys* n.sp. and *T. dundasensis* n.sp. from which they may be distinguished by the relatively narrow upper margin of clypeus.

Etymology. The specific name is from the Latin adjective meaning very hairy referring to the femora of the male.

Distribution. Avon wheatbelt area of Western Australia (AW, GS, JF) (Fig. 87).

Trichocolletes centralis n.sp.

Figs 52, 88

Type. Holotype ♂, 30 km W Sandstone [27.59S, 119.18E], Western Australia, 7 Sep. 1981, T. F. Houston, on flowers of *Daviesia grahami*, in WAM 13563. Co-ordinates on the label refer to the location of Sandstone at 27°59'S 119°18'E.

Specimens examined. The holotype and the following. **New South Wales**: 3♂, Dolo Creek (31.6933°S 142.8697°E), 7 Sep. 2007, M. Batley, AM (K.334669–71). **Queensland**: ♂, 34 km E Cunnamulla (28.0456°S 146.0658°E), 24 Aug. 2007, M. Batley, AM (K.334668); 7♂, 2♀, 70 mi NW Quilpie, 17 Aug. 1968, J. C. & T. F. Houston, on *Crotolaria eremaea*, SAM (32-024508,10,11) & UQIC; 2♂, 4♀, 8 mi NE Windorah, 16 Aug. 1968, J. C. & T. F. Houston, on *Kennedia prorepens*, UQIC & SAM (32-024509). **South Australia**: ♂, ♀, 70 mi N Marree, 13 Aug. 1969, E. M. Exley, UQIC; 3♂, 9♀, Simpson Desert, 15–18 Sep. 1971, T. F. Houston, on *Swainsona, Crotalaria, Goodenia* & *Helipterum*, SAM (32-024645–56). **Western Australia**: 3♂, 2♀, 24–25 km ENE Beyondie HS, 17–20 Aug. 1984, T. F. Houston & B. P. Hanich, on flowers of *Thryptomene maisonneuvei* & *Scaevola spinescens*, WAM (13540–44); ♀, Beyondie Little Sandy Desert (24.5833°S 120.2833°E), 28 Aug. 1997, D. Knowles & A. Start, visiting *Swainsona*, WAM (21021); ♂, ♀, Cardabia, K. T. Richards, WAA (45286–87); ♂, 36 km N Charlies Knob, 1 Aug. 1983, T. F. Houston & R. P. McMillan, on flowers of *Swainsona*, WAM (13558); ♂, 28 km N Charlies Knob, 6 Aug. 1983, T. F. Houston & R. P. McMillan, on flowers of *Dicrastylis exsuccosa*, WAM (13557); 6♂, 37 km SW Glenayle HS, 6–9 Aug. 1983, T. F. Houston & R. P. McMillan, on flowers of *Swainsona*, WAM (13547–52); 3♂, ♀, Karijini National Park (22.5250°S 118.7833°E), 20 Aug. 2001, T. F. Houston, on flowers of *Gompholobium polyzygum*, WAM (29092–95); 8♂, 2♀, 15 km N Kumarina Hotel, 21 Aug. 1984, T. F. Houston & B. P. Hanich, on flowers of *Thryptomene maisonneuvei* & *Swainsona*, WAM (13530–39); ♀, 28 km WSW Lenister, 11 Aug. 1983, T. F. Houston & R. P. McMillan, on flowers of *Baeckea stowardii*, WAM (13556); ♂, 33 km WSW Lenister, 11 Aug. 1983, T. F. Houston & R. P. McMillan, on flowers of *Dicrastylis brunnea*, WAM (13555); ♂, ♀, 30 km NW Lorna Glen HS, 10 Aug. 1983, T. F. Houston & R. P. McMillan, on flowers of *Ptilotus obovatus*, WAM (13553–54); 2♂, 17 km E Mt Nossiter, 7 Aug. 1983, T. F. Houston & R. P. McMillan, on flowers of *Dicrastylis exsuccosa*, WAM (13559–60); 4♂, 30 km W Sandstone, 7 Sep. 1981, T. F. Houston, on flowers of *Daviesia grahami*, WAM (13563–67); 2♀, 8 km NE Tamala HS (26.70°S 113.71°E), 21–23 Aug. 1980, C. A. Howard & T. F. Houston, on flowers of *Mirbelia ramulosa*, WAM (13835, 14422); 3♂, 7♀, 16 km SW Tangadee HS, 22 Aug. 1984, T. F. Houston & B. P. Hanich, on flowers of *Swainsona*, WAM (13520–29); 2♂, ♀, 25 km SW Tangadee HS, 22 Aug. 1984, T. F. Houston & B. P. Hanich, on flowers of *Swainsona*, WAM (13523,45,46); ♂, 7 km N Wongawol HS, 29–30 Jul. 1983, T. F. Houston & R. P. McMillan, WAM (13561); ♀, Woomera, 15 Sep. 1968, H. Mincham, on flowering legume shrub, SAM (32-024507).

Diagnosis

Length 11–13 mm; eyes not hairy; malar space short; metasoma sericeous with broad bands. Male metasoma slender; legs slender; tibiae, tarsi and antenna ventrally orange-brown. Female pubescence of scutum short, dense; only hind tarsal claw with small inner ramus.

Variation

The colour of the metasomal bands varies from silver to moderately bright gold and that of the scutal hair ranges from orange-brown to almost white. No correlation was found between colour and geographic location. The apical half of the flagellum is darkened ventrally in some males.

Descriptions

Male (holotype).—*Head* width 3.80 mm, body length 11.8 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 32, LID 31, DMA 30, HVO 5, WOC 14, MOD 4, OOD 8, IAD 9, ASD 3, AOD 8, ML 20, BMW 7, MSL 1.0, SL 12, SW 3, FL c. 53.—*Eyes* not hairy; face narrow; malar space short (length c. 0.1× basal mandibular width); length flagellomeres c. 1.5× width. Legs slender; hind tarsus 1.2× as long as hind tibia; hind basitarsus 3.5× as long as wide; posterior carina of basitibial area reaches apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with long, thin posterior projections and ligulate processes, rectangular lateral lobes with sinuate posterior margin (Fig. 52).—*Labrum* cream; ventral rim clypeus amber; scape, pedicel, flagellum ventrally, tarsi, tibiae and femora orange-brown, with medial brown areas on fore and mid femora; flagellum dorsally, coxae, trochanters dark brown. T1–5 with broad, pale gold bands (see variation); T7 and large part of S6 orange-brown.—*Scutum* with dull sheen, weak pit-reticulation and dense, small punctures.—*Face* with dense orange hair, erect on clypeus. Scutum with close, long, plumose, orange hair; fore basitarsus with tapered golden plume; hind femur with fringe of long hair on anterior margin; metasoma sericeus with semi-adpressed simple hair.

Female (WAM13523).—*Head* width 4.00 mm, body length 12.6 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 32, LID 32, DMA 30, HVO 4, WOC 13, MOD 3, OOD 8, IAD 7, ASD 4, AOD 9, ML 20, BMW 6, MSL 0.5, SL 15, SW 3, FL c. 32.—*Eyes* not hairy; face quadrate; malar space short (length c. 0.1× basal mandibular width); clypeus transversely convex; middle flagellomeres as long as wide; inner hind tibial spur with c. 7 long, well-spaced teeth; fore tibial calcar with c. 5–6 strong teeth; hind tarsal claw only with small inner ramus; pygidial plate apically entire with broad medial elevation.—*Labrum*, mandibles medially, apical rim clypeus amber; anterior margins of fore and mid tibia orange-brown; remainder of legs dark brown. T1–4 with broad pale gold bands, narrowly ferruginous across anterior margin.—*Clypeus* reticulate basally, with large punctures, becoming polished and sparsely punctate apically. Scutal sculpture as for male.—*Face* with long white, plumose hair, becoming dark brown near ocelli, dense in apicolateral corners of clypeus, paraocular areas and on frons, sparse on clypeus and supraclypeal area. Scutum densely covered with short, finely-branched, pale brown or orange-brown hair; tibial scopa white or pale orange except near basitibial area; prepygidial fimbria gold.

Remarks. This species is referred to as F246 (part), M219, F273 and M228 in Houston (2000).

Etymology. The specific name, used as a Latin adjective, refers to the regions where the species has been found.

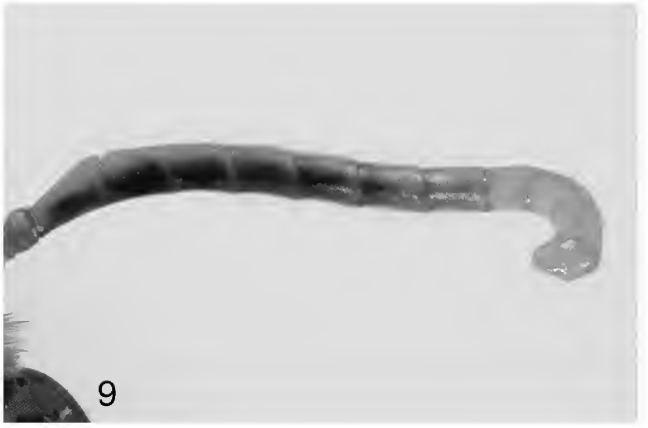
Distribution. Central, arid areas of Australia (BHC, CHC, GAS, GAW, GD, GS, LSD, ML, MUR, PIL, SSD, STP) (Fig. 88).

T. sericeus

T. rufibasis

T. dives (dorsal view)

T. hackeri (anterior view)



T. pulcherrimus (dorsal view)

Figs 5–9. Parts of antennae of male *Trichocolletes* illustrating: (5) swollen and (6) non-swollen scapes; (7) modified F1 and F11; (8) crenulate flagellum and (9) modified F11.

Trichocolletes chrysostomus (Cockerell)

Figs 53, 89

Paracolletes chrysostomus Cockerell, 1929a p. 202 (male).
Trichocolletes (Trichocolletes) chrysostomus.—Michener, 1965 p. 79.
Paracolletes marginatus lucidus Cockerell, 1929a, p. 203 (female). **n. syn.**
Trichocolletes (Trichocolletes) lucidus.—Michener, 1965 p. 80.

Specimens examined. The holotypes of *T. chrysostomus* ♂, Eradu, Western Australia, Nicolson, 8 Sep. 1926, AM (K.95633) and *T. lucidus* ♀, Geraldton, Western Australia, Nicolson, 4 Sep. 1926, AM (K.95634) and the following. **South Australia**: 6♂, Hincks Nat. Pk (33.50°S 136.90°E), 12 Oct. 1972, C. A. & T. F. Houston, on *Dillwynia uncinata*, SAM (32-024627 to 32); ♀, Kimba-Wudinna Road, 8 Oct. 1974, T. F. Houston, SAM (32-024633); ♂, 35 km E Wudinna (33.1581°S 135.8219°E), 15 Sep. 2004, M. Batley, AM (K.316503). **Western Australia**: ♂, 3♀, Badgingarra National Park, 1–3 Oct. 1980, T. F. Houston, on flowers of *Jacksonia*, WAM (13568–71); ♂, ♀, Badgingarra Natl Park (30.5306°S 115.4306°E), 15 Sep. 1995, J. Cane & L. Kervin, ex *Daviesia*?, WAM (32095–96); ♂, ♀, 18 km NW Eneabba, 9–12 Sep. 1987, T. F. Houston, on flowers of *Jacksonia ulicina*, WAM (13578, 13858); ♂, 31 km 9° W of N Eneabba, 28 Aug. 1999, T. F. Houston, on flowers of *Daviesia incrassata* ssp. *teres*, WAM (27522); ♂, c. 5 km W Eurardy HS (27.6611°S 114.6944°E), 24 Aug. 1999, T. F. Houston, on flowers of *Jacksonia cupulifera*, WAM (27505); ♂, 13 mi N Geraldton, 19 Aug. 1971, T. F. Houston, SAM (32-024626); ♂, Kenwick, 14 km SE Perth, 10 Sep. 1980, J. Lewis, on *Bossaeia*, WAM (13600); 6♀, Watheroo National Park (30.20°S 115.83°E), 3–5 Oct. 1980, T. F. Houston, on flowers of *Daviesia brevifolia*, WAM (13572–77).

Diagnosis

Length male c. 12 mm, female c. 13 mm; eyes not hairy; metasomal bands moderately wide; prominent supraclypeal area inclined to clypeus, viewed laterally. Male scapes swollen; supraclypeal area bare, polished, impunctate on anterior surface; female clypeus with open, large punctures.

Descriptions

Male (AM K.316503).—*Head* width 3.6 mm, body length 11.9 mm. Relative dimensions: HW 50, HL 41, UID 33, UFW 32, LID 30, DMA 30, HVO 4, WOC 15, MOD 5, OOD 9, IAD 8, ASD 3, AOD 8, ML 19, BMW 6, MSL 1.5, SL 12, SW 6, FL c.44.—*Eyes* not hairy; face narrow, inner orbits subparallel; malar space c. 0.3× basal width mandible; scape swollen (width 0.48× length); anterior face supraclypeal area pentagonal, weakly depressed medially, inclined relative to clypeus viewed laterally; flagellomeres F1–6 flattened ventrally and conspicuously hirsute; middle flagellomeres slightly longer than wide. Legs robust; mid basitarsus short (length 2.3× width); hind tarsus 1.1× as long as hind tibia; hind basitarsus 4.3× as long as wide; basitibial area flattened but acarinate. Genital capsule similar to that for *T. sericeus* (Fig. 40); S7 with triangular lateral lobes, basal teeth obsolete, posterior projections small (Fig. 53).—*Labrum*, mandible medially, scape, mid and hind tarsi, distal ends femora, proximal ends tibiae, ventral surfaces flagellomeres F1–6, distal half F11 orange-brown; legs and remainder of flagellum brown. T1–5 with broad, orange-gold bands, ferruginous across anterior margin.—Anterior face of supraclypeal area polished and impunctate, clypeus densely punctate, except apical margin; scutum dull with strong pit-reticulation obscuring punctures.—*Face*, except supraclypeal area, with dense, long, minutely-branched, bright orange hair. Scutum with close, long, plumose, orange hair; fore basitarsi without distinct plume; posterior margin of mid basitarsus with dense fringe of long, golden hair; trochanters and hind femur with copious, long, golden hair.

Female (WAM 13568).—*Head* width 4.2 mm, body length 13.0 mm. Relative dimensions: HW 50, HL 39, UID 31, UFW 33, LID 32, DMA 30, HVO 3, WOC 15, MOD 4, OOD 8, IAD 8, ASD 4, AOD 9, ML 19, BMW 7, MSL 2, SL 15, SW 3, FL c. 28.—*Eyes* not hairy; face approximately quadrate, inner orbits parallel; length malar space c. 0.3× basal width mandible; basal suture clypeus straight; supraclypeal area with triangular anterior face at distinct angle to clypeus viewed laterally; flagellum moderately short; middle flagellomeres approximately as long as wide; inner hind tibial spur with c. 12 long teeth; hind basitibial area large, c. 0.3× as long as hind tibia; tarsal claws with large, triangular inner ramus; pygidial plate emarginate, strongly sculptured.—*Labrum*, mandible medially, ventral rim of clypeus, f3–10 ventrally, orange-brown; scape, remainder of flagellum and legs dark brown, with dull orange-brown on anterior surface of fore tibia. T1–4 with moderately wide silver-white bands.—*Clypeus* reticulate with open, large punctures; anterior face of supraclypeal area with sparse punctures; remainder of face densely punctured; scutum dull with strong pit-reticulation.—*Face* with long, white, plumose hair becoming pale orange-brown near ocelli, dense in paraocular areas and on frons, sparse on clypeus and supraclypeal area. Scutum with close, short, plumose, dark-tipped brown hair; hind tibial scopa orange-brown except dark brown near basitibial area; prepygidial fimbria golden-brown.

Remarks. The holotypes of *T. chrysostomus* and *T. lucidus* both carry labels with the word "TYPE" in Cockerell's hand.

This species is similar to *T. sericeus*, which is found in the eastern half of the continent. Both sexes have a shorter head length than *T. sericeus* and males may be distinguished by the bare, sparsely punctate supraclypeal area and females by the less dense punctures of the clypeus. The female specimens examined were less brightly coloured than many of the males, which may be a result of their collection later in the season.

This species is referred to as F248/M221 and M222 in Houston (2000).

Distribution. Coastal Western Australia and southern South Australia (EYB, GS, MAL, SWA) (Fig. 89).

Trichocolletes dives (Cockerell)

Figs 7, 23, 31, 54, 90

Anthoglossa dives Cockerell, 1914b, p. 39.
Trichocolletes (Trichocolletes) dives.—Michener, 1965, p. 79.

Specimens examined. The holotype ♀, Yallingup, nr Cape Naturaliste, Western Australia, R. E. Turner, Sep. 14–31 Oct. 1913, BMNH Hym.17.a.393 and the following. **Western Australia**: ♂, ♀, Barracca Nature Reserve, 8 km NE Muchea, 23 Jul. & 13 Aug. 1999, T. F. Houston, on flowers of *Daviesia physodes*, WAM (27174, 82); ♀, Cannington, 16 Oct. 1954, R. P. McMillan, WAM (13512); ♀, Chidlow, 1 Jun. 1934, WAA (45284); ♀, 18 km NW Eneabba, 9–12 Sep. 1987, T. F. Houston, on flowers of *Daviesia*, WAM (13978); ♂, 16 km NW Eneabba, 24 Jun. 1999, T. F. Houston, on flowers of *Daviesia trifolia*, WAM (27173); 2♀, 25 km 15° W of N Eneabba, 28 Aug. 1999, T. F. Houston, on flowers of *Jacksonia hakeoides*, WAM (27520–21); ♀, 28 km 26° W of N Eneabba, 28 Aug. 1999, T. F. Houston, on flowers of *Daviesia divaricata*, WAM (27513); 4♂, ♀, 31 km 9°W of N Eneabba, 23–25 Jun. 1999, T. F. Houston, on flowers of *Daviesia trifolia*, WAM (27169–72, 79); ♂, ♀, Mahogany Ck, WAM (13511); ♂, Nabawa, 9 Jul. 1998, S. R. Patterson, WAM (21391); ♂, Stathams, WAM (13505); ♀, 1.5 km S Yallingup, 12–13 Nov. 1986, T. F. Houston, on flowers of *Daviesia*, WAM (13979); ♂, Yanchep-Lancelin Road 10 km ESE Guilderton, 28 Aug. 1982, T. F. Houston, on flowers of *Daviesia divaricata*, WAM (13503).

Diagnosis

Length c. 14 mm; eyes not hairy; metasomal bands wide, bright gold; clypeus wholly (male) or partly (female) yellow-brown and sparsely punctate. Male flagellum very long with apical segment expanded and flattened.

Variation

Males from the Yanchep-Busselton area at the southern end of the known range exhibit generally denser pubescence and a curved, ventrally expanded first flagellomere.

Descriptions

Male (WAM 27175).—*Head* width 4.4 mm, body length 13.9 mm. Relative dimensions: HW 50, HL 34, UID 29, UFW 30, LID 32, DMA 32, HVO 5, WOC 13, MOD 3, OOD 8, IAD 9, ASD 4, AOD 6, ML 21, BMW 6, MSL 2,

SL 8, SW 4, FL c. 78.—*Eyes* not hairy; face broad; inner orbits ventrally divergent; clypeus flattened apicolaterally; length malar space c. 0.4× basal width mandible; labrum truncate, uniformly convex; scape short and swollen (width 0.5× length); flagellum much longer than head width; F2–9 c. 2.8× as long as wide, F11 and part F10 flattened and expanded (Fig. 7). Legs long and slender; hind tarsus c. 1.3× as long as hind tibia; hind tibia gently bowed transversely; hind basitarsus c. 6.0× as long as wide, gently bowed longitudinally; posterior carina of hind basitibial area extends slightly past apex. Costal margin of third submarginal cell of forewing noticeably narrow. Gonoforceps with sparse hair, narrowed preapically (Fig. 31); S7 with lateral lobes compressed and fused with posterior projections and basal teeth (Fig. 54).—*Clypeus* yellow-brown; labrum, scape, mandible medially, tarsi, distal half fore femur, anterior faces mid femur, fore and mid tibia, orange-brown; remainder of legs dark brown; flagellomeres F1–9 mottled orange-brown ventrally, dark brown dorsally, F11 ventrally with large, medial brown patch. T1–5 with broad gold bands; T7 red-brown. Wings darkened.—*Clypeus* weakly reticulate, shining, with scattered setiferous punctures; supraclypeal area densely punctate; scutum strongly pit-reticulate and indistinctly punctate.—*Face* above base of clypeus with dense, erect, finely-branched, orange hair; lower paraocular area with short, adpressed, pale hair; clypeus with sparse, long, simple, orange hair. Scutum with close, plumose, dark-tipped pale brown hair; fore trochanter and femur with copious, long, orange hair; fore basitarsus without plume; anterior margin of hind tibia with fringe of mid-length orange hair.

Female (WAM 27182).—*Head* width 4.5 mm, body length 14.3 mm. Relative dimensions: HW 50, HL 37, UID 29, UFW 31, LID 31, DMA 31, HVO 4, WOC 13, MOD 3, OOD 8, IAD 7, ASD 3, AOD 8, ML 21, BMW 7, MSL 1, SL 13, SW 3, FL c. 36.—*Eyes* not hairy; face broad, inner orbits slightly divergent ventrally; malar space c. 0.25× basal width mandible; clypeus uniformly convex with slight sagittal flattening; supraclypeal area prominent; frontal carina ending in small tubercle on supraclypeal area; flagellum moderately long; middle flagellomeres c. 1.2× as long as wide; basitibial area well-defined with sharp edges on both margins (obscured by setae unless worn) (Fig. 23); tarsal claws simple; inner hind tibial spur with c. 8 strong teeth; pygidial plate very broad and coarsely sculptured.—*Labrum*, mandible medially, apical half of clypeus orange-brown; legs, flagellum dark brown. T1–4 with broad, gold bands, ferruginous across anterior margin.—*Clypeus* reticulate, shining with scattered, large punctures, supraclypeal area with contiguous, large punctures; scutum dull with strong pit-reticulation.—*Face* with long, brown, plumose hair, dense in paraocular areas and on frons, open on supraclypeal area and sparse on clypeus. Scutum with close, short, plumose, dark-tipped pale brown hair; prepygidial fimbria honey-coloured; hind tibial scopa dark brown.

Remarks. This species is referred to as *T. dives* and F258 in Houston (2000).

Distribution. Southern coastal Western Australia (JF, GS, SWA) (Fig. 90).

Trichocolletes dowerinensis Rayment

Figs 32, 41, 55, 91

Trichocolletes dowerinensis Rayment, 1931, p. 162 (male).

Specimens examined. The holotype ♂, Dowerin, Western Australia, ANIC and the following. **Western Australia**: ♂, 9 km E by S Carrabin, 9 Oct. 1981, I. D. Naumann & J. C. Cardale, ANIC; ♂, Bejoording, Dec. 1949, R. P. McMillan, WAM (13818); 3♀, Boorabbin Rock, 4–9 Oct. 1981, T. F. Houston, on flowers of *Daviesia croniniana* & *Jacksonia*, WAM (13848–50); 3♂, 2♀, Broomehill, WAM (13712,74–76,13820); ♀, 22 km N Bullfinch, 7 Sep. 1979, T. F. Houston, on flowers of *Swainsona microphylla*, WAM (13967); ♂, Cunderin, Aug.–Sep. 1913, WAM (13822); ♂, Dryandra, 11 Oct. 1965, A. Douglas, WAM (13519); 6♂, 31 km 9° W of N Eneabba, 28 Aug. 1999, T. F. Houston, on flowers of *Daviesia incrassata* ssp. *teres*, WAM (27526–31); ♀, Eneabba, 6 Sep. 1996, R. P. McMillan, on flowers of *Jacksonia ulicina*, WAM (18463); ♂, Eneabba, 13 Sep. 1996, R. P. McMillan, on *Daviesia*, WAM (21023); ♀, NE Eneabba, 27 Aug. 1995, J. Cane & L. Kervin, ex *Daviesia* sp., WAM (32094); ♀, 60 km N Esperance (33.3611°S 121.6992°E), 29 Sep. 2004, M. Batley, *ex Daviesia* sp., AM (K.316513); 4♂, 13 km 35°S of W Eurardy HS (27.7611°S 114.5694°E), 25–26 Aug. 1999, T. F. Houston, on flowers of *Mirbelia trichocalyx* and *Jacksonia velutina*, WAM (27495–98); 6♀, 61 km E Hyden, 14 Oct. 1978, T. F. Houston, on flowers of *Burtonia hendersoni*, WAM (13842–47); ♂, 7.5 km WSW Lake Cronin, 19–26 Sep. 1978, T. F. Houston, on flowers of *Daviesia aphylla* and *Gastrolobium* sp., WAM (13516–17); 3♂, ♀, 5.5–6.5 km SW McDermid Rock, 27 Sep.–3 Oct. 1978, T. F. Houston, on flowers of *Pultenaea* sp. & *Daviesia aphylla*, WAM (13513–5, 13855); ♂, Merredin, Oct. 1948, A. Douglas, WAM (13821); ♂, Minnivale, WAM (13715); 2♀, Mt Observation, 21 Oct. 1987, R. P. McMillan, WAM (13853–54); ♂, National Park, WAM (13819); ♂, ♀, 6 km W Newdegate (33.1011°S 118.9639°E), 8 Oct. 2009, M. Batley, *ex Gastrolobium ilicifolium*, AM; ♂, 2♀, North Tarin Rock Reserve (32.98°S 118.23°E), 16–18 Oct. 1985, T. F. Houston, on flowers of *Gastrolobium* sp., WAM (13518, 13851–52); ♂, ♀, Stirling Ranges NP SE Camel Lake, 2 Oct. 1995, J. Cane & L. Kervin, *ex Gastrolobium spinosum* & *Daviesia flexuosa*, WAM (32098); ♀, 12 km NW Tarin Rock (33.0544°S 118.1456°E), 9 Oct. 2009, M. Batley, *ex Gastrolobium glaucum*, AM; ♀, Tutanning Reserve 18–25 km E Pingelly, 30 Oct.–3 Nov. 1980, T. F. Houston, on flowers of *Daviesia brevifolia*, WAM (13856); ♂, Wamenusking, WAM (13761); 2♂, 2♀, 15 km N Westonia (31.1981°S 118.7586°E), 19 Sep. 2004, M. Batley, ex *Gastrolobium* sp., AM (K.316509–12); ♂, 23 km E Yellowdine, 10 Oct. 1981, I. D. Naumann & J. C. Cardale, ANIC.

Diagnosis

Length male c. 12 mm, female c. 14 mm; eyes hairy; metasomal bands broad silver. Male hind tibia and basitarsus broad, flat; metasoma with prominent stiff, black setae. Female pygidial plate with deep, linear emargination, tarsal claws simple.

Descriptions

Male (K.316510).—*Head* width 4.25 mm, body length 11.9 mm. Relative dimensions: HW 50, HL 36, UID 33, UFW 33, LID 30, DMA 29, HVO 4, WOC 15, MOD 4, OOD 9, IAD 9, ASD 3, AOD 9, ML 18, BMW 7, MSL 2.5, SL 15, SW 4, FL c. 54.—*Eyes* hairy; face broad, inner orbits slightly convergent ventrally; length malar space c. 0.45× basal width mandible; middle flagellomeres c. 1.25× as long as wide; fore and mid basitarsi bowed transversely; mid basitarsus broad and laterally compressed; hind basitarsus flattened with slight transverse curvature and expanded posteriorly (ta2,3 less strongly expanded); hind tarsus 1.1× as long as tibia; hind basitarsus 2.4× as long as wide; basitibial region separated from surroundings by sharp edges; fore tibial calcar with short apical spine but without teeth. Penis valves short (Fig. 32); S7 unlike any other species, lateral lobes rounded and bulbous (Fig. 55).—*Labrum*, mandible basally, apical half of clypeus milky or yellow-brown; basal 10% scape

orange-brown; femora, tibiae and tarsi orange-brown with dark suffusions on femora; anterior face fore basitarsus with cream marking; ventral surface flagellum brown. T1–3 with broad silver-white bands, remaining terga with similar bands becoming increasingly translucent from T4 to T6.—*Scutum* strongly reticulate.—*Face* with dense, long, erect, plumose, orange hair. Scutum with open, long, plumose, dull orange hair; fore basitarsus without plume; margins of hind tibia and tarsi with conspicuous fringes of open, long, white hair; T3–7 with scattered, erect, long black setae, denser on T6,7.

Female (AM K.316509), not previously described.—*Head* width 4.6 mm, body length 13.9 mm. Relative dimensions: HW 50, HL 36, UID 31, UFW 32, LID 31, DMA 29, HVO 3, WOC 14, MOD 4, OOD 8, IAD 8, ASD 3, AOD 9, ML 19, BMW 6, MSL 2, SL 16, SW 3, FL c. 30.—*Eyes* hairy; face broad, inner orbits parallel; length malar space c. 0.35× basal width mandible; clypeus convex, sagittally flattened; supraclypeal area prominent; middle flagellomeres c. 1.3× as long as wide; inner hind tibial spur with c. 11 teeth; basitibial area relatively small, well-defined except apically; tarsal claws simple; fore tibial calcar with 0 to 2 teeth; pygidial plate with long, linear emargination.—*Labrum*, mandible medially, tibiae, tarsi, anterior surface of fore femur and distal ends of mid and hind femora, orange-brown; apical half clypeus dark brown. T1–4 with white apical bands.—*Clypeus* very weakly reticulate with medium to large punctures, dense medially, sparse laterally; extreme lateral margins densely and finely punctate; supraclypeal area impunctate medially, margins densely punctate.—Paraocular areas and frons with long, plumose pale orange-brown hair, white in lower paraocular areas; scutum with open, plumose, brown-tipped, pale orange hair; prepygidial fimbra dark brown.

Remarks. The female has not previously been described. This species is referred to as F257/M218 in Houston (2000).

Distribution. Southwestern Western Australia (AW, COO, ESP, GS, JF, MAL) (Fig. 91).

Trichocolletes dundasensis n.sp.

Fig. 92

Type. Holotype ♀, 5.5–6.5 km SW McDermid Rock, Western Australia (32.02°S 120.73°E), 27 Sep. to 3 Oct. 1978, T. F. Houston, on flowers of *Daviesia aphylla,* in WAM 13608.

Specimens examined. The holotype and the following. **Western Australia:** 2♀, same data as holotype, WAM (13611,12); ♀, Kanowna, 21 Aug. 1974, A. M. & M. J. Douglas, on *Mesembrion*, WAM (13892); ♀, 16 km S Norseman (32.3403°S 121.7575°E), 7 Oct. 2009, M. Batley, *ex Daviesia benthamii*, AM (K.344672); ♀, North Tarin Rock Reserve (32.98°S 118.23°E), 16–18 Oct. 1985, T. F. Houston, on flowers of *Gastrolobium* sp., WAM (13899); ♀, Torndirrup (35.10°S 117.92°E), 25 May–1 Nov. 1983, P. H. Dyer & J. Lyon, WAM (13980); 2♀, Tutanning Reserve 18–25 km E Pingelly, 30 Oct.–3 Nov. 1980, T. F. Houston, on flowers of *Daviesiaa brevifolia*, WAM (13897–98).

Diagnosis

Female (male unknown) eyes hairy; clypeus flattened; metasomal bands narrow, silver; supraclypeal area broad; lateral epistomal suture straight.

Description

Female (holotype).—*Head* width 4.20 mm, body length 12.1 mm. HW 50, HL 36, UID 29, UFW 32, LID 31, DMA 31, HVO 5, WOC 13, MOD 3, OOD 8, IAD 8, ASD 4, AOD 9, ML 19, BMW 7, MSL 2.0, SL 14, SW 3, FL c. 33.—*Eyes* hairy; face wider than long; length malar space c. 0.25× basal mandibular width; clypeus protuberant, sagittally flattened or slightly depressed; basal suture shallow V-shape; basal width clypeus >2× length subantennal suture; supraclypeal area viewed laterally at distinct angle to base clypeus; epistomal suture between base of clypeus and base of mandible straight; distance from anterior tentorial pit to base of mandible 2× distance from pit to base clypeus; frontal carina ends in small tubercle on supraclypeal area; middle flagellomeres c. 1.2× as long as wide; inner hind tibial spur with c. 7 teeth; tarsal claws simple; pygidial plate entire, flat medially.—*Labrum*, rim of clypeus, distal ends of femora and anterior surface of fore tibia orange-brown. T1–4 with narrow silver bands.—*Clypeus* weakly reticulate with large punctures, dense medially, close laterally; scutum with dull sheen, strongly pit-reticulate with close, small punctures.—*Face* with pale orange-brown hair, darker near ocelli, sparse on clypeus and supraclypeal area, dense elsewhere. Scutum with close, plumose, orange-brown hair with dark tips; prepygidial fimbria dark brown or black.

Remarks. Similar to *T. capillosus* n.sp. from which it differs by the width of the supraclypeal area and to *T. leucogenys* n.sp. (see below).

Etymology. The specific name is a Latin adjective meaning from Dundas, an abandoned gold-mining town near one of the collection sites.

Distribution. Southwestern Australia (AW, COO, MAL, MUR) (Fig. 92).

Trichocolletes eremophilae Houston

Fig. 93

Trichocolletes (Trichocolletes) eremophilae Houston, 1990, p. 615.

Diagnosis

Eyes not hairy; proboscis relatively elongate, prementum length at least 3.5× eye width viewed laterally. Gena of female produced posterioventrally; lower clypeus sparsely punctate and shining; facial hair brown, simple; mid-tibial spur strongly curved and serrate medially; prepygidial fimbria black. Hair on clypeus of male erect, appearing cropped; T7 wholly yellow-brown; fore basitarsus unmodified; fore calcar with c. 3 teeth.

Remarks. Exhibits a preference for flowers of *Eremophila*. Detailed descriptions are given by Houston (1990).

Distribution. South Western Australia between Geraldton, Meekatharra and Kalgoorlie (GS, MUR, YAL) (Fig. 93).

Trichocolletes erythrurus (Cockerell)

Figs 56, 94

Paracolletes erythrurus Cockerell, 1914a, p. 5.
Trichocolletes (Trichocolletes) erythrurus.—Michener, 1965, p. 79.

Specimens examined. The holotype ♀, in BMNH (Hym 17.a.456) and the following. **Western Australia**: ♀, 91 km NE Albany (34.4781°S 118.6283°E), 23 Oct. 2009, M. Batley, AM (K.316520); ♀, 5–8 km ENE Augusta, 27 Oct. 1982, C. A. Howard & T. F. Houston, on flowers of *Viminaria*, WAM (13957); ♂, Bannister, WAM (13962); ♀, Beekeepers Reserve Eneabba-Leeman-Jurien area, M. Lyons, WAM (13924); 2♂, Bickley, Perth, 24 Sep. 1985, R. Peakall, on flowers of *Kennedia concinna*, WAM (13946–47); ♀, N Broke Inlet, 26 Oct. 1982, C. A. Howard & T. F. Houston, on flowers of *Viminaria*, WAM (13958); ♀, Brookton Hwy Darling Range E of Karragullen, 17 Sep. 1978, T. F. Houston, on flowers of *Kennedia concinna*, WAM (13954); ♀, 1 km NE Bullsbrook East, 11 Oct. 1980, C. A. Howard & T. F. Houston, on flowers of *Gastrolobium*, WAM (13925); ♂, 9♀, Calgardup, WAM (13938–45, 63–64); ♀, Cannington, 16 Oct. 1954, R. P. McMillan, WAM (13961); 7♂, ♀, Deanmill, 5 Oct. 1982, R. P. McMillan, WAM (13930–37); ♂, Denmark, Oct., L. J. Newman, WAA (80824); ♀, Dryandra, 2 Nov. 1992, M. R. Williams, WAM (13917); ♂, 5♀, Dryandra State Forest 27 km NW Narrogin, 10 Dec. 1991, T. F. Houston, on flowers of *Gastrolobium parviflorum* & *Bossaeia*, WAM (13911–16); 2♂, Gooseberry Hill 19 km E Perth, 28 Aug. 1993, T. F. Houston, patrolling flowers of *Daviesia*, WAM (13921–22); 3♂, 3♀, Gooseberry Hill (31.9528°S 116.0486°E), 16 Sep. 2003 & 24 Sep. 2004, M. Batley, *ex Chorizema dicksonii, Kennedia coccinea* & *Hardenbergia comptoniana*, AM (K.316514–19); 11♂, 3♀, Kalgan-Manypeaks NE Albany, 18 Oct. 1974, C. A. & T. F. Houston, on flowers of *Chorizema*, SAM (32-024546–59); ♀, King George Sound, AM (K.48370); 3♂, 2♀, Koondoola Cons. Area 12 km N Perth, 22 Sep. 2000, T. F. Houston, on flowers of *Gompholobium confertum*, WAM (27801–05); ♂, 4♀, Margaret R., WAM (13950-52,65–66); 2♀, 7.5 km SW Margaret River, 18 Nov. 1986, T. F. Houston, on flowers of *Viminaria*, WAM (13948–49); ♀, Meelup Beach road 27 km W Busselton, 25 Oct. 1992, T. F. Houston, on flowers of book-leaf poison, WAM (13923); ♂, Murdoch 13 km S Perth, 13 Oct. 1980, T. F. Houston, on flowers of *Daviesia polyphylla*, WAM (13926); ♂, 17.3 km S Mogumber, 11 Sep. 1988, R. P. McMillan, on flowers of *Gastrolobium bennettsianum*, WAM (13959); ♀, 14 km NW Narrogin (32.8761°S 117.0425°E), 9 Oct. 2009, M. Batley, *ex Gastrolobium* sp., AM (K.316521); ♂, 50mil N Ravensthorpe, 25 Aug. 1964, G. Lallfitz, WAM (13956); ♀, 63 km E Ravensthorpe (33.6753°S 120.6928°E), 8 Oct. 2009, M. Batley, AM; ♂, 5 km S Pemberton, 26 Sep. 1987, D. K. McAlpine, AM (K.316665); ♂, Point Heron Area, 2 Oct. 1977, A. M. & M. J. Douglas, WAM (13955); ♂, Porongurup, 11 Oct. 1925, K. A. Spenser, WAM (13960); 2♂, ♀, Stirling Range, 17 Oct. 1974, C. A. & T. F. Houston, on flowers of *Daviesia*, SAM (32-024544–45,67); ♂, 2♀, Stirling Ranges NP, SE Camel Lake, 2 Oct. 1995, J. Cane & L. Kervin, *ex Gastrolobium spinosum* & *Bossaiea linophylla*, WAM (32097,99,101); ♂, Swan River, Sep., WAA (80834); ♀, Adjacent E side of Walyunga Nat. Park 35 km NE Perth, 9 Oct. 1978, T. F. Houston, on flowers of *Gastrolobium calycinum*, WAM (13953); ♂, 2♀, c. 10 km NE Wannamal RS, 10 Sep. 1983, C. A. & T. F. Houston, on flowers of *Gastrolobium*, WAM (13918–20); ♂, Williams, 21 Oct. 1991, S.R Patterson, WAM (18464); ♂, Yallingup, nr Cape Naturaliste, 14 Sep.–31 Oct. 1913, R. E. Turner, BM.

Diagnosis

Length c. 12 mm; eyes not hairy; metasoma red-brown; metasomal bands absent or indistinct. Male hind legs unmodified; female with a polished, impunctate area below and laterad of antennal sockets.

Descriptions

Male (K.316519).—*Head* width 3.9 mm, body length 11.9 mm. Relative dimensions: HW 50, HL 36, UID 33, UFW 33, LID 30, DMA 29, HVO 4, WOC 15, MOD 4, OOD 9, IAD 9, ASD 3, AOD 9, ML 18, BMW 7, MSL 2.5, SL 15, SW 4, FL c. 54.—*Eyes* not hairy; face broad, inner orbits ventrally divergent; malar space c. 0.45× basal width mandible; middle flagellomeres c. 1.6× as long as wide, weakly crenulate. Legs slender; hind tarsus 1.1× as long as hind tibia; hind basitarsus 6.0× as long as wide; basitibial area indistinct. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with narrow, triangular lateral lobes fused with basal teeth, posterior projections and ligulate processes long and thin (Fig. 56).—Integument of head and mesosoma black except labrum, mandible basally, white or milky amber; apical half clypeus pale amber; scape, tibiae, tarsi and distal ends of femora, orange-brown; flagellum ventrally and large patch on posterior half of mid tibia, brown. Metasoma orange-brown with irregular dark brown brown markings on lateral margins all terga, glandular area on lateral margins T2, black.—*Scutum* dull with strong pit-reticulation obscuring punctures.—*Face* with dense, long, finely-branched, orange hair, stiffly erect on clypeus. Scutum with open, long, finely-branched, orange hair; fore basitarsus with short brush; trochanters with long, white hair; T1,2 with sparse, long, pale orange hair; T3–7 with a mixture of adpressed and semi-erect dark brown hair.

Female (AM K.316518).—*Head* width 4.5 mm, body length 12.2 mm. Relative dimensions: HW 50, HL 36, UID 31, UFW 32, LID 31, DMA 29, HVO 3, WOC 14, MOD 4, OOD 8, IAD 8, ASD 3, AOD 9, ML 19, BMW 6, MSL 2, SL 16, SW 3, FL c. 30.—*Eyes* not hairy; face broad, inner orbits slightly divergent ventrally; length malar space c. 0.2× basal width mandible; clypeus uniformly convex; supraclypeal area convex, protruberant; middle flagellomeres c. 1.1× as long as wide; inner hind tibial spur with c. 9 teeth; tarsal claws simple; pygidial plate entire, medial longitudinal elevation narrow.—Integument of head and mesosoma black except labrum, ventral rim of clypeus, mandible medially, tarsi, tibiae and apices of femora, orange-brown; tibiae with areas of brown posteriorly. Metasoma orange-brown, occasionally with darker suffusions; glandular area on lateral margin T2 black or dark brown.—*Clypeus* basally weakly reticulate with close, large punctures, apically sparsely punctured, polished; supraclypeal area with contiguous punctures coalescing to form irregular grooves; paraocular area densely punctate except impunctate and polished below and laterad of antennal socket. Scutum dull with strong pit-reticulation.—*Face* with off-white hair, brown-tipped near ocelli, dense in paraocular areas and on frons, sparse on clypeus. Scutum with close, short, plumose, pale brown hair; hind tibial scopa pale brown; T2–5 openly covered with simple, short, adpressed, dark brown hair; prepygidial fimbria pale brown.

Remarks. This species is referred to as F261/M232 in Houston (2000).

Distribution. Southwestern Australia (AW, ESP, JF, MAL, WAR, SWA) (Fig. 94).

Trichocolletes fuscus n.sp.

Figs 57–58, 95

Type. Holotype ♂, Munghorn Gap NR, New South Wales (32.4247°S 149.8353°E), 10 Sep. 2005, M. Batley, *ex Leucopogon lanceolatus*, in AM K.278551.

Specimens examined. The holotype and the following. **New South Wales**: ♂, same data as holotype; 2♂, Conimbla NP (33.7972°S 148.4442°E), 30 Sep. 2005, M. Batley, *ex Leucopogon ericoides*, AM (K.344696–97); 2♂, ♀, 45 km NE Hillston (33.1906°S 145.8672°E), 19 Sep. 2005, M. Batley, *ex Templetonia aculeata*, AM (K.344692–94); 19♂, 7♀, 27 km S Mount

Hope (32.9936°S 145.9006°E), 19 Sep. 2005, 3 Sep. 2007 & 1 Sep. 2009, M. Batley, *ex Eutaxia microphylla*, AM (K.344678–91, K.344698–705, K.344709–11); ♂, Mount Wilson (33.5417°S 150.3414°E), 24 Sep. 2002, M. Batley, *ex Daviesia ulicifolia*, AM (K.344674); ♂, Pilliga NR (30.7442°S 149.5131°E), 18 Sep. 2000, M. Batley, *ex Pultenaea microphylla*, AM (K.344673); 2♂, Turramurra (33.6864°S 151.1600°E), 28–29 Aug. 2005, M. Batley, *ex Dillwynia retorta*, AM (K.344675–76).

Diagnosis

Length 10–11 mm; eyes hairy; metasomal bands moderately narrow, gold. Male fore basitarsus with plume; S7 with subtriangular lateral lobes (Figs 57–58). Female basal margin of the clypeus V-shaped; inner hind tibial spur with c. 7 teeth; pygidial plate with weak medial elevation.

Variation

S7 of males varies in shape with the degree of emargination between the anterior edge of the lateral lobe and the basal tooth ranging from no emargination to strong emargination (Figs 57–58). A population from one collection site, yielded specimens covering half the total range of variation. No correlation between the shape of S7 and geographic location was found.

Descriptions

Male (holotype).—*Head* width 3.90 mm, body length 10.8 mm. Relative dimensions: HW 50, HL 37, UID 30, UFW 32, LID 31, DMA 30, HVO 4, WOC 14, MOD 3, OOD 9, IAD 9, ASD 4, AOD 9, ML 19, BMW 7, MSL 2.5, SL 13, SW 3, FL c. 50.—*Eyes* hairy; face wider than long, inner orbits parallel; malar space c. 0.35× basal mandibular width; length flagellum equal to head width, middle flagellomeres c. 1.4×as long as wide. Legs slender; length fore basitarsus 0.25× head width; hind tarsus as long as hind tibia; hind basitarsus 4.3× as long as wide; basitibial area with weak posterior carina almost reaching apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with short posterior processes, triangular lateral lobes either fused with basal teeth or separated from them by a small emargination (Figs 57–58).—*Labrum*, mandible medially, scape, hind tibia, anterior faces fore and mid tibiae orange-brown. T1–5 with narrow, gold bands; T7 dull orange-brown.—*Clypeus* densely punctate except apical 20% impunctate and polished; scutum dull with strong pit-reticulation and barely visible, open punctation.—*Face* with dense, long, finely-branched, bright orange hair. Scutum with open, plumose bright orange hair; fore basitarsus with tapered orange plume; trochanters with abundant long, pale hair.

Female (AM K.334688).—*Head* width 4.00 mm, body length 10.4 mm. Relative dimensions: HW 50, HL 37, UID 30, UFW 32, LID 31, DMA 31, HVO 3, WOC 14, MOD 3, OOD 8, IAD 8, ASD 4, AOD 9, ML 22, BMW 7, MSL 1.5, SL 15, SW 3, FL c. 33.—*Eyes* hairy; face broad; inner orbits parallel; malar space moderately short (length c. 0.15× basal mandibular width); clypeus gently convex, at most slightly flattened basally, basal suture shallow V-shaped; flagellum moderately short, middle flagellomeres c. 1.3× as long as wide; inner hind tibial spur with c. 7 teeth; tarsal claws simple; pygidial plate emarginate, with weak but strongly sculptured medial elevation.—*Labrum*, mandible medially, tarsi, hind tibia, front surface of fore and mid tibiae, distal ends of femora orange brown; remainder of legs dark brown. T1–4 with moderately narrow gold bands.—*Clypeus* closely to densely punctate, dulled basally with pit-reticulation; supraclypeal area with dense punctures coalescing to form irregular longitudinal grooves; scutum with dull sheen, moderately strong reticulation with small, close punctures.—*Face* with long, plumose, pale orange hair becoming darker near ocelli, dense in paraocular areas and on frons, open on clypeus and supraclypeal area. Scutum with close, moderately short, plumose, orange hair; prepygidial fimbria honey-brown.

Remarks. Similar to *T. aeratus* n.sp., but darker, with narrower, bronze metasomal bands and sparser scutal hair. Males may be distinguished from *T. aeratus* n.sp. by presence of fore basitarsal plume and the shape of S7, while females differ in the V-shaped basal margin of clypeus (smoothly concave in *T. aeratus* n.sp.) and the smaller number of teeth on the inner hind tibial spur.

Etymology. The specific epithet is a Latin adjective meaning dusky.

Distribution. Central New South Wales from coast to western plains (BBS, MDD, NSS, SB) (Fig. 95).

Trichocolletes gelasinus n.sp.

Figs 14–15, 33, 59, 96

Type. Holotype ♂, Neerabup National Park, 38 km NNW Perth, Western Australia (31.74°S 115.77°E), 13 Aug. 2000, T. F. Houston, on flowers of *Hardenbergia comptoniana*, in WAM 27809.

Specimens examined. The holotype and the following. **Western Australia**: 4♂, same data as holotype; ♀, Barracca Nature Reserve, 8 km NE Muchea, 23 Jul. 1999, T. F. Houston, on flowers of *Daviesia physodes*, WAM (27180); ♀, Beechboro, 3 Sep. 1969, R. J. Lawrence, WAA (80848); ♂, ♀, Beekeepers Reserve Eneabba-Leeman-Jurien area, 18–19 Jul. 1987, M. Lyons, WAM (13638–39); 3♂, Boranup, 11 Sep. 1965, G. H. Riley, WAM (13812–14); ♂, Busselton, 4 Sep. 1943, O. Dawson, ANIC; 19♂, 8♀, Cottesloe, WAM (13715–16,19–20,22–46); ♀, Drummond Cove, 6 Mar. 1973, N. McFarland, WAA (45288); 4♂,3♀, 13mi. N Geraldton, 19 Oct. 1971, T. F. Houston, SAM (32-024634–40); 3♀, 13 km S Grass Patch, 17 Oct. 1974, I. D. Naumann & J. C. Cardale, ANIC; 2♀, 25 km 15°W of N Eneabba, 28 Aug. 1999, T. F. Houston, WAM (27518–19); ♀, 31 km 9° W of N Eneabba, 28 Aug. 1999, T. F. Houston, WAM (27532); 4♀, Watheroo NP, 3–5 Oct. 1980, T. F. Houston, on flowers of *Daviesia divaricata*, WAM (13837,39–41); ♂, 18 km NW Eneabba, 9–12 Sep. 1987, T. F. Houston, on flowers of *Daviesia*, WAM (13640); 2♀, c. 5 km W Eurardy HS, 24 Aug. 1999, T. F. Houston, WAM (27506–07); 5♀, 5 km 23°N of W Eurardy HS, 27 Aug. 1999, T. F. Houston, WAM (27500–04); 5♀, ♂, Kings Park, Western Australia, 10 Oct. 1988, T. F. Houston, WAM (18456–61); ♂, Knights Track Beekeepers Reserve Eneabba-Leeman-Jurien area, 2 Jul. 1987, M. Lyons, on flowers of *Daviesia quadrilatera*, WAM (13637); 2♂, Margt R. Dist., Aug. & Oct. 1912, WAM (13795) & ANIC; 4♀, Stirling Range, 17 Oct. 1974, C. A. & T. F. Houston, SAM (32-024641–44); 3♀, Swanbourne, WAM (13782–84); ♀, Swan River, Sep., L. J. Newman, WAA (80828); 6♂, Swan River, Jul., D. Swan, WAA (45274–6,79–81); ♂, Tathra NP, 26 Jul. 1995, R. P. McMillan, WAM (21022); 3♂, Yanchep-Lancelin Rd 10 km ESE Guilderton, 26 Aug. 1982, T. F. Houston, on flowers of *Daviesia divaricata*, WAM (13634–36).

Diagnosis

Length 13–14 mm; eyes not hairy; metasomal bands broad, white. Male flagellum distinctively modified (Fig. 14); female labrum elongated, tectiform (Fig. 15); malar space short.

Descriptions

Male (holotype).—*Head* width 4.35 mm, body length 13.1 mm. Relative dimensions: HW 50, HL 36, UID 30, UFW 32, LID 30, DMA 28, HVO 4, WOC 14, MOD 4, OOD 9, IAD 9, ASD 3, AOD 8, ML 21, BMW 6, MSL 1.5, SL 11, SW 3, FL c. 54.—*Eyes* not hairy; face wide, inner orbits subparallel; length malar area c. 0.25× basal mandibular width; flagellum longer than head width; distal flagellomere expanded, truncate with apical concavity (Fig. 14); middle flagellomeres crenulate, 1.7× as long as wide. Legs slender; hind tarsus as long as hind tibia; hind basitarsus 4.3× as long as wide; posterior carina of basitibial area almost reaching apex; malus of fore tibial calcar truncate and deflexed forming margin of velum. Apex of gonoforceps transversely rather than obliquely truncate (Fig. 33); S7 with large rectangular opening to cavity in the rectangular lateral lobes (Fig. 59).—*Labrum*, mandible, scape, tarsi, hind tibia, apices fore and mid tibiae orange-brown; flagellum and remainder of legs dark brown. T1–5 with broad white bands narrowly ferruginous across anterior margin; T7 red-brown.—*Scutum* dull with strong pit-reticulation.—*Face* with dense long, plumose, bright orange hair. Scutum with close to dense, long, plumose, orange hair; fore basitarsus with weak, pale gold plume; anterior margin of hind tibia with weak row of finely-branched white hair.

Female (WAM 18457).—*Head* width 4.50 mm, body length 14.0 mm. Relative dimensions: HW 50, HL 37, UID 30, UFW 32, LID 31, DMA 28, HVO 3, WOC 13, MOD 3, OOD 8, IAD 7, ASD 3, AOD 9, ML 21, BMW 6, MSL 1.0, SL 14, SW 3, FL c. 35.—Robust; eyes not hairy; face almost quadrate, inner orbits parallel; length malar space c. 0.15× basal mandibular width; clypeus transversely convex; supraclypeal area prominent; labrum long (length 0.75× width), somewhat tectiform but not carinate (Fig. 15); middle flagellomeres 1.1× as long as wide; apical flagellomere obliquely truncate; inner hind tibial spur with c. 11 strong teeth; fore tibial calcar with c. 4 fine teeth; tarsal claws with large, sharp inner ramus; pygidial plate broad, coarsely coriarius with low, broad medial elevation.—*Labrum*, mandible, tarsi and tibiae orange-brown; outer faces of fore and hind tibiae and basitarsi with dark brown suffusions; lower margin of clypeus dark brown. T1–4 with broad, white bands narrowly ferruginous across anterior margins; pygidial plate dull red basally, darker apically; wings darkened.—*Clypeus* pit-reticulate with dull sheen, closely punctate except along midline.—*Face* with long, plumose hair, pale ventrally becoming orange-brown towards ocelli, sparse on clypeus and supraclypeal area, dense in paraocular areas, apicolateral corners of clypeus and on frons. Scutum with close, short, plumose, dark-tipped orange-brown hair; prepygidial fimbria orange-brown.

Remarks. Smith (1853) incorrectly associated male and female specimens from different species in his original description of *Anthoglossa plumata*, as Michener (1965) implied. Mr David Notton (BMNH) kindly examined, described and photographed the male specimen described as *A. plumata* by Smith and confirmed that it matched the description given above. Accordingly, the female specimen BMNH Hym.17.a.394 is here formally designated as the lectotype of *Anthoglossa plumata*.

Trichocolletes gelasinus is referred to as F251/M226 (part) in Houston (2000).

Etymology. The specific name, used as a noun in apposition, is from the Latin word for dimple and refers to the apex of the male flagellum.

Distribution. Coastal southwestern Australia (ESP, GS, MAL, SWA) (Fig. 96).

Trichocolletes grandis n.sp.

Figs 11, 60, 97

Type. Holotype ♂, 50 km SE Broken Hill, New South Wales (32.1831°S 141.9067°E), 8 Sep. 2007, M. Batley, *ex Swainsona viridis*, in AM K.278552.

Specimens examined. The holotype and the following. **New South Wales**: 5♀, same data as holotype, AM (K.344718–22); 5♀, 50 km E Broken Hill (31.8875°S 141.9592°E), 7 Sep. 2007, M. Batley, *ex Swainsona viridis*, AM (K.344714–17,28); 5♀, 18 km S Ivanhoe (33.0036°S 144.4433°E), 25 Sep. 2010, M. Batley, AM (K.344723–27); 2♀, Kinchega NP (32.4272°S 142.3497°E), 29 Sep. 2003, M. Batley, *ex Swainsona purpurea*, AM (K.344712–13). **South Australia**: 2♂, 4♀, 42 km E Coober Pedy on Oodnadatta Rd, late July 1991, B. Greenwood, ANIC.

Diagnosis

Length c. 13 mm; eyes hairy; metasomal bands silver; gena wide; vertex elevated; colour of metasoma variable. Labrum usually black in both sexes, but see comments on variation. Male gena with dense white hair.

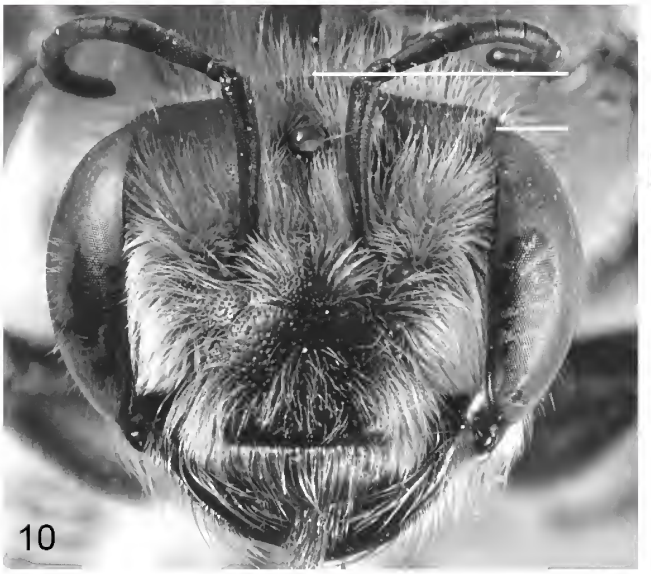
Variation

Specimens collected at Coober Pedy were strikingly different in colour from those collected elsewhere. Males differed primarily in the colour of the pubescence, but females exhibited altered integumental colour. The metasoma of females was mostly red, legs brown and labrum amber, instead of black. Coober Pedy females retained weak metasomal hair bands but the integumental colour bands on the terga were frequently indistinct. One specimen exhibited intermediate colouring, with large areas of dark brown on T1,2, integumental metasomal colour bands and darker legs. Both sexes from Coober Pedy had strongly orange-brown pubescence, but this may have been the result of mineral staining. In all other respects, including the elevated vertex, dense genal hair and intermediate length setae on the eyes, the specimens were identical to those from other locations.

The scapes of one male specimen were black, but all other males had orange scapes.

Descriptions

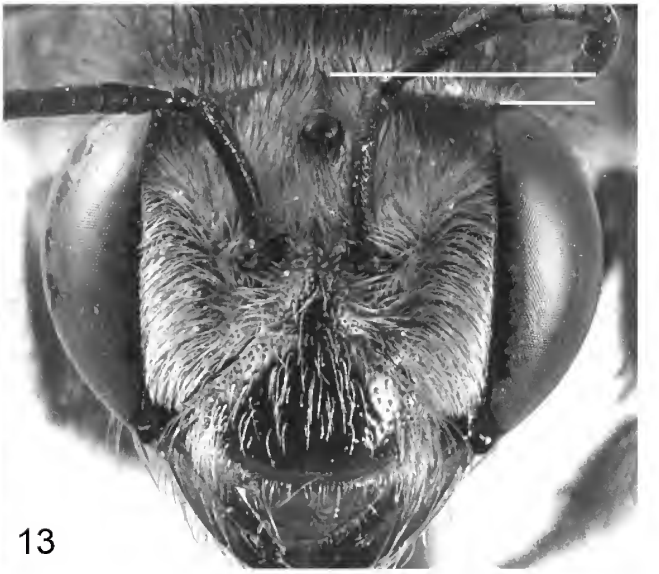
Male (holotype).—*Head* width 4.05 mm, body length 12.6 mm. Relative dimensions: HW 50, HL 41, UID 32, UFW 33, LID 32, DMA 33, HVO 4, WOC 14, MOD 3, OOD 9, IAD 9, ASD 3, AOD 8, ML 18, BMW 8, MSL 1.0, SL 14, SW 4, FL c. 44.—*Eyes* hairy, but length of setae about half that in other hairy-eyed species, face broad, inner orbits approximately parallel, malar area short (length c. 0.1× basal mandibular width), clypeus protuberant, vertex elevated, gena 0.7× as wide as eye viewed laterally, flagellum shorter than head width, middle flagellomeres c. 1.4× as long as wide. Legs slender, hind tarsus 1.1× as long as hind tibia, hind basitarsus 3.9× as long as wide, posterior carina of basitibial area reaches apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with slightly rounded, rectangular lateral lobes and large basal teeth (Fig. 60).—*Scape*, small area of mandible medially, tarsi, hind tibia, small areas on fore and



T. maximus

T. grandis n.sp.

T. venustus



T. nitens n.sp.

Figs 10–13. Faces of female *Trichocolletes* with elevated (10 and 11) or normal (12 and 13) vertex.

mid tibiae and flagellomeres F2–7 ventrally, orange-brown. T1–5 with moderately broad, silver bands.—*Clypeus* with dense, fine punctures except rim impunctate and polished, scutum dull with strong pit-reticulation and small, close to dense punctures.—*Face* with dense, long, pale orange hair, finely-branched on clypeus, becoming plumose towards vertex, gena with very dense, finely-branched white hair. Scutum closely covered with long, plumose, pale orange hair, fore basitarsus with pale gold plume, anterior margin of hind tibia with sparse fringe long, white hair, metasoma with scattered, erect, white hair in addition to the normal semi-adpressed hair matching the underlying integument.

Female (AM K.344714).—*Head* width 4.05 mm, body length 13.0 mm. Relative dimensions: HW 50, HL 40, UID 31, UFW 33, LID 33, DMA 34, HVO 5, WOC 14, MOD 3, OOD 9, IAD 9, ASD 3, AOD 10, ML 18, BMW 8, MSL 1.0, SL 15, SW 3, FL c. 33.—*Eyes* hairy, length of setae as for male, face broad, inner orbits approximately parallel, malar space short (length c. 0.1× basal mandibular width), clypeus convex both longitudinally and transversely with small longitudinal depression medially, vertex elevated, gena 0.85× as wide as eye viewed laterally, middle flagellomeres as long as wide, inner hind tibial spur with c. 7 teeth, tarsal claws simple, pygidial plate broad, entire, without medial elevation.—*Mandible* medially red-brown. T1–4 with moderately broad, silver bands.—*Clypeus* reticulate with large, close to dense punctures, sculpture of scutum as for male.—*Face* with long, white, finely-branched hair, close to dense in paraocular areas and on frons, open on clypeus, gena with close to dense long, white, finely-branched hair. Scutum with close to dense moderately long, plumose, pale orange hair. T1–4 with weak but distinct apical hair bands covering the silver integumental bands, prepygidial fimbra pale brown, tibial scopa white, darker near basitibial area.

Etymology. The specific name is a Latin adjective referring to the relatively large size of this species.

Distribution. Arid areas of western New South Wales and South Australia (BHC, DRP, RIV, STP) (Fig. 97).

Figs 14–15. *Trichocolletes gelasinus* n.sp. (14) apex of male flagellum (15) clypeus and labrum of female.

Trichocolletes hackeri (Cockerell)

Figs 8, 61, 98

Anthoglossa hackeri Cockerell, 1913b, p. 373.
Trichocolletes (Trichocolletes) hackeri.—Michener, 1965, p. 79.

Specimens examined. The holotype ♀, Tambourine Mountain, Queensland, 27 Oct. 1912, H. Hacker, QM (Hy/4080) and the following. **New South Wales**: 4♂, Gibraltar Range NP, 16 Nov. 1979, N. W. Rodd, AM (K.316670–73); ♀, 3 km N Lansdowne, 15 Nov. 1985, G. Williams, *ex Acmena smithii*, AM (K.316696); 2♀, Macquarie Pass (34.5961°S 150.6714°E), 30 Oct. 2007, M. Batley, AM (K.316522–23); 2♂, Tooloom Scrub via Urbanville, 22 Oct. 1972, G. B. Monteith, UQIC; ♂, ♀, 8 km W Tyalgum, 23 Sep. 1983, N. W. Rodd, AM (K.316680–81). **Queensland**: ♀, Beechmont, 5 Oct. 1984, N. W. Rodd, AM (K.316682); ♀, Bunya Mtns, 24 Oct. 1958, S. Sekhon, UQIC; ♀, Bunya Mtns, 24 Oct. 1958, C. D. Michener, UQIC; ♂, 2♀, Bunya Mtns, 29 Nov. 1967, T. F. Houston, WAM (8993–95); 4♀, Bunya Mts, 29 Nov. 1967, T. F. Houston, SAM (32-024477,79,80,82); ♂, Mt Glorious, 8 Oct. 1966, J. C. Cardale, UQIC; 2♂, Mt Lindesay, 15 Nov. 1967, T. F. Houston, SAM (32-024478,81); ♂, Mt Lindesay, 15 Nov. 1967, T. F. Houston, UQIC; ♂, Mt Lindesay, 15 Nov. 1967, T. F. Houston, WAM (8996); ♂, ♀, Natnl Pk, Dec. 1921, H. Hacker, ANIC; 11♂, Natnl Pk, Dec. 1921, H. Hacker, QM; 2♂, 4♀, 18 km S Ravenshoe, 9 Sep. 1983, N. W. Rodd, AM (K.316674–79); 12♂, ♀, 18 km S Ravenshoe, 16 Oct. 1984, N. W. Rodd, AM (K.316683–95); 5♂, 4♀, Tamborine Mountain, 24, 27 Oct. 1912, H. Hacker, *Parsonia velutina*, QM.

Diagnosis

Eyes not hairy; colouring unlike any other species, metasoma dull black with bright, metallic gold metasomal bands. Labial palpus of both sexes very short and flattened. Male flagellum strongly crenulate; hind legs long and slender. Female tarsal claws cleft, scutal pubescence dark grey or grey-brown.

Descriptions

Male (AM K.316672).—*Head* width 3.9 mm, body length 12.0 mm. Relative dimensions: HW 50, HL 36, UID 28.5, UFW 31, LID 30, DMA 30, HVO 4, WOC 12, MOD 4, OOD 9, IAD 9, ASD 3, AOD 7, ML 21, BMW 7, MSL 1, SL 13, SW 5, FL c. 70.—*Eyes* not hairy; face narrow, longer than wide, inner orbits approximately parallel; length malar space c. 0.2× basal width mandible; scape stout, barely reaching medial ocellus (width 0.35× length); flagellum long, crenulate (Fig. 8). Legs long, slender; hind tarsus 1.46× as long as hind tibia; basitarsus 9.1× as long as wide, slightly bowed at proximal end; fore basitarsus short, length 0.3× head width; posterior margin of hind basitibial area with carina not reaching apex. Genital capsule generally similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with very long posterior projections, small lateral lobes and rounded basal teeth (Fig. 61).—*Labrum*, ventral rim of clypeus, mandible medially translucent amber; tibiae, tarsi, anterior face of fore femur, distal ends mid and hind femora orange-brown; flagellum and remainder of legs dark brown. T1–5 with brilliant, metallic gold bands, narrow on T1, wide on T2–5; T7 red-brown.—*Scutum* dull with close, fine punctures.—*Face* with dense, plumose, pale orange hair, stiffly erect on clypeus, frons with longer, golden-orange hair. Scutum closely covered with long, plumose, orange hair; fore basitarsus with fringe of moderate length orange hair.

Female (AM K.316522).—*Head* width 4.20 mm, body length 13.0 mm. Relative dimensions: HW 50, HL 37, UID 28, UFW 32, LID 32, DMA 32, HVO 4, WOC 12, MOD 3, OOD 8, IAD 9, ASD 3, AOD 10, ML 22, BMW 7, MSL 0.8, SL 16, SW 3, FL c. 36.—*Eyes* not hairy; face approximately quadrate, inner orbits parallel; malar space short (length c. 0.1× basal mandibular width); clypeus gently convex; labrum uniformly convex except for slight medial depression; flagellum moderately short; middle flagellomeres 1.25× as long as wide; inner hind tibial spur with c. 6 widely spaced teeth; basitibial area without distinct margins, not elevated above surroundings; tarsal claws cleft; pygidial plate weakly emarginate.—*Labrum*, mandible medially, flagellum ventrally and most of legs dark brown. T1–4 with wide, bright metallic gold bands.—*Clypeus* dull with pit-reticulation on basal half, densely punctate becoming open apicolaterally, supraclypeal area with dense small punctures, scutum dull, pit-reticulate with close, fine punctures.—*Face* with long, plumose, white hair becoming golden brown near ocelli, dense in paraocular areas and on frons, open on clypeus and supraclypeal area. Scutum openly covered with long, plumose, dark grey hair; mesepisternum, propodeum laterally and T1 with dull white hair.

Distribution. Rainforest areas of eastern Australia (NNC, SB, SEQ) (Fig. 98).

Trichocolletes lacaris n.sp.

Figs 27, 62, 99

Type. Holotype ♂, Lake Callabonna, South Australia, 1 Aug. 1969, H. Mincham, in SAM 32-024564.

Specimens examined. The holotype and the following. **South Australia**: ♀, data as for holotype, SAM (32-024565); 3♂, Lake Palankarinna, 28–31 Jul. 1984, D. Lacis, SAM (32-024560–62); ♀, NE edge Lake Puntawolona Tirari Desert, 21 Aug. 1971, M. Archer, WAM (13798); ♂, Tirari Desert Lake Ngapakaldi, eastern shore, 6 Aug. 1984, D. Lacis, SAM (32-024563). **Western Australia**: ♂, 7♀, 7 mi E Carnarvon, 21 Aug. 1971, T. F. Houston, on *Swainsona occidentalis*, SAM (32-024671–78); ♀, off Kendrew Island (20.5889°S 116.5639°E), 26 Jul. 1999, S. M. Slack-Smith & M. Hewitt, at sea, WAM (27144).

Diagnosis

Length c. 12–13 mm; eyes hairy; metasomal bands wide, silver, ferruginous across anterior margins; legs black. Male S7 with broad, rounded lateral lobes and short posterior projections (Fig. 62). Female hind tarsal claw without an inner ramus.

Variation

Specimens from Western Australia had noticeably darker pubescence than those from South Australia, but were otherwise indistinguishable. The solitary male from Western Australia was smaller (length 10 mm) and had fore and hind basitarsi that were shorter and hence stouter by c. 25% than males from South Australia, but otherwise differed only in colour. As leg shape may vary allometrically and colour variation might be environmentally induced (Rayment, 1929), the species was not divided based on a small number of available specimens.

Descriptions

Male (holotype).—*Head* width 4.50 mm, body length 12.8 mm. Relative dimensions: HW 50, HL 33, UID 33, UFW 34, LID 31, DMA 31, HVO 5, WOC 14, MOD 4, OOD 10, IAD 9, ASD 3, AOD 9, ML 21, BMW 6, MSL 1.0, SL 14, SW 3, FL c. 44.—*Eyes* hairy; face almost quadrate; length malar space c.0.2× basal mandibular width; length flagellum less than head width, middle flagellomeres c. 1.5× as long as wide. Legs slender; fore basitarsus thickened strongly near calcar; hind tarsus 1.1× as long as hind tibia; hind basitarsus 4.9× as long as wide; hind basitibial area with strong posterior carina extending well past apex. In the specimen from Carnarvon, the carina is complete and the basitibial area distinctly elevated above the surrounding area (Fig. 27). Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with broad, rounded lateral lobes and short posterior projections (Fig. 62).—Distitarsi and flagellum (partly or wholly) ventrally orange-brown; labrum, mandible and remainder of tarsi dark brown. T1–5 with broad, silver bands, ferruginous across anterior margins.—*Scutum* pit-reticulate with dull sheen and close, small punctures.—*Face* with dense, long, erect, finely-branched, pale orange hair. Scutum closely covered with long, finely-branched, pale orange hair; fore basitarsus with long white plume; mid trochanter and hind femur with very long, white, plumose hair.

Female (SAM 32-024565).—*Head* width 4.60 mm, body length 13.9 mm. Relative dimensions: HW 50, HL 35, UID 31, UFW 34, LID 32, DMA 32, HVO 5, WOC 14, MOD 4, OOD 9, IAD 8, ASD 3, AOD 10, ML 24, BMW 7, MSL 1.0, SL 15, SW 3, FL c. 33.—*Eyes* hairy; face broad, inner orbits parallel; length malar space c. 0.2× basal mandibular width; clypeus gently convex transversely; middle flagellomeres c. 1.4× as long as wide; inner hind tibial spur with c. 8 long teeth; tarsal claws simple; pygidial plate entire with flat or slightly upturned margin.—Integument black, except distitarsi orange-brown, legs occasionally, mandible, labrum apically and pygidial plate dark brown. T1–4 with wide silver bands, ferruginous across anterior margin.—*Clypeus* weakly reticulate, closely to densely punctate; scutum dull with moderately strong pit-reticulation and close to dense, small punctures.—*Face* with long, plumose, white hair, open or close on clypeus and supraclypeal area, dense in paraocular areas and on frons; vertex with long, plumose, cream or pale brown hair. Scutum and scutellum with plumose, cream or pale brown hair of moderate length; prepygidial fimbria white or very pale brown.

Remarks. Similar to *T. brunilabrum* n.sp., from which males may be distinguished by the shape of S7 and females by the absence of an inner ramus on the hind tarsal claw and the larger size. This species also resembles *T. micans* n.sp. and *T. tuberatus* n.sp. (see below).

Etymology. The specific name is a Latin adjective meaning of a lake referring to several of the collection sites.

Distribution. Arid regions of South Australia and coastal Western Australia north of Shark Bay (CAR, FLB, PIL, SSD) (Fig. 99).

Trichocolletes latifrons (Cockerell)

Figs 34, 63, 100

Paracolletes latifrons Cockerell, 1914b, p. 41.
Trichocolletes (Trichocolletes) latifrons.—Michener, 1965, p. 80.

Specimens examined. The holotype ♀, Coolangatta, Queensland, BMNH (Hym 17.a.486) and the following. **New South Wales**: ♂, Wooloweyah (29.5172°S 153.3678°E), 28 Aug. 2007, M. Batley, *ex Gompholobium virgatum*, AM (K.316502); 3♀, Yamba, 29 Aug. 1992, N. W. Rodd, AM (K.316697–99). **Queensland**: ♂, 5♀, Burleigh, 25 Sep. 1958 and 3–15 Sep. 1965, A. N. Burns, MV (16550–55); ♀, Coolangatta, 11 Sep. 1913, QM (HY/2393).

Diagnosis

Length 12–13 mm; eyes not hairy; metasomal bands indistinct; clypeus short. Male clypeal hair relatively short, stiffly erect; mid basitarsus unmodified; ventral surface of hind femur with hair. Female tarsal claws with inner rami; T2–4 with white hair.

Descriptions

Male (AM K.316502), not previously described.—*Head* width 4.0 mm, body length 12.0 mm. Relative dimensions: HW 50, HL 36, UID 29, UFW 30, LID 32, DMA 30, HVO 3, WOC 12, MOD 4, OOD 9, IAD 9, ASD 4, AOD 7, ML 20, BMW 6, MSL 3, SL 12, SW 5, FL c. 55.—*Eyes* not hairy; face broad, inner orbits strongly divergent ventrally; length malar space c. 0.6× basal width mandible; clypeus short (length 0.35× width); scape mildly swollen (width 0.42× length); flagellum long, middle flagellomeres c. 1.7×

as long as wide. Legs slender; distitarsi moderately broad; mid basitarsus short, broad, 2.9× as long as wide; hind tarsus 1.30× as long as hind tibia; hind basitarsus 5.6× as long as wide; posterior carina of basitibial area almost reaching apex. Gonoforceps broad apically with sparse hair (Fig. 34); S7 with very wide rectangular lateral lobes and small posterior projections (Fig. 63).—*Labrum* and ventral rim of clypeus, scape, mandible medially, tibiae, tarsi and distal ends of femora, orange-brown, with darker suffusions on posterior faces of femora, fore and mid basitarsi; flagellum ventrally, dark brown (with some orange-brown suffusions). T2–5 with indistinct golden brown bands, sterna black.—*Scutum* dull with weak pit-reticulation.—*Face* with dense, plumose, bright orange hair, stiffly erect on clypeus and supraclypeal area, longer and dorsally directed on frons, basal margin of clypeus bare. Scutum closely covered with long, finely-branched, orange hair; fore basitarsus with weak plume; mid and hind trochanters with dense plumes of white hair; hind basitarsus with fringe of sparse, sinuous, white hair on anterior margin. T1,2 with sparse cover of long, finely-branched, golden hair; T3–6 with relatively long, semi-adpressed hair matching underlying integument, but with golden reflections.

Female (AM K.316697).—*Head* width 4.35 mm, body length 12.9 mm. Relative dimensions: HW 50, HL 36, UID 27, UFW 31, LID 32, DMA 32, HVO 3, WOC 7, MOD 4, OOD 8, IAD 8, ASD 3, AOD 9, ML 21, BMW 8, MSL 1.5, SL 15, SW 3, FL c. 33.—*Face* longer than wide; inner orbits ventrally divergent; length malar space c. 0.3× basal width mandible; clypeus transversely convex, with short, shallow sagittal concavity basally; frontal carina strong ending as small tubercle on supraclypeal area; middle flagellomeres c. as long as wide; inner hind tibial spur with c. 12 strong teeth; tarsal claws with strong inner rami; pygidial plate entire with upturned margin and moderately strong medial elevation.—*Labrum*, ventral margin clypeus dark red-brown; mandible medially deep amber. T1,2 with apical margins brownish; legs dark brown.—*Clypeus* weakly reticulate, densely punctate except apically; scutum weakly reticulate, punctures open to close; T1–4 with change of texture on apical margins.—*Clypeus* and supraclypeal area with open, long, finely-branched, white hair, close in apicolateral corners of clypeus and paraocular areas; frons with close, long, plumose, white hair; vertex with dark brown, plumose hair.—*Scutum* openly covered with short, plumose hair, white across anterior margin, dark brown elsewhere; metanotum closely covered with longer, plumose, white hair. T1 sparsely covered with finely-branched, white hair; T2–4 with short, adpressed, white hair forming apical fringes, complete on T4, interrupted medially on T3 and restricted to lateral margins of T2; prepygidial fimbra mid brown.

Remarks. Although there was no coincident collection, two separate locations yielded both sexes on different days but at similar times of the year. Their distinctive morphology makes it unlikely that they belong to different species.

Similar to *T. burnsi* from which male may be distinguished by clypeal hair, unmodified mid basitarsus and hair beneath hind femur. Female may be distinguished from *T. burnsi* by inner rami on tarsal claws and white hair on T2–4.

Distribution. Coastal areas of southern Queensland and northern New South Wales (NNC, SEQ) (Fig. 100).

Trichocolletes leucogenys n.sp.

Figs 64, 101

Type. Holotype ♂, Dryandra State Forest c. 27 km NW Narrogin, Western Australia, 3 Oct. 1982, C. A. Howard & T. F. Houston, on flowers of *Gastrolobium*, in WAM 13580.

Specimens examined. The holotype and the following. **Western Australia**: ♂, 5♀, same data as holotype, WAM (13579, 81–85); 2♂,2♀, Bolgart, 8 Aug. 1949 &12 Jan. 1950, ANIC; ♀, Broomehill, WAM (13777); ♀, Busselton, 25 Jun. 1943, O. Dawson, ANIC; 12♂, 7♀, Cottesloe, WAM (13681–93, 13718,21,28–29,14011–12); ♀, 37 km E Cramphorne (31.7847°S 118.9533°E), 20 Oct. 2009, M. Batley, AM (K.344730); ♀, Darlington-Helena Valley, 21 Jul. 1987, M. Lyons, on flowers of *Muris* sp. & *Daviesia*, WAM (13623); ♀, Deepdene, 4 Sep. 1963, L. M. O'Halloran, WAM (13799); 2♀, Dryandra State Forest 27 km NW Narrogin, 12 Oct. 1991, T. F. Houston, on flowers of *Gastrolobium parviflorum*, WAM (13586–87); 2♂, Dryandra, Sep. 1977, WAM (13790–91); ♂, 16 km NE Dumbleyung (33.2200°S 117.8486°E), 9 Oct. 2009, M. Batley, AM (K.344734); 8♀, 166 km W Esperance, 16 Oct. 1974, C. A. & T. F. Houston, SAM (32-024612–19); ♂, ♀, 12 mls N Geraldton, 12 Jul. 1973, N. McFarland, WAA (45289–91); 2♂, Gooseberry Hill, 20 Aug. 1993, T. F. Houston, patrolling flowers of *Daviesia*, WAM (13593–94); ♂, Helena Valley, 4 Aug. 1987, R. Peakall, on flowers of *Isopogon*, WAM (13857); ♀, Kalbarri, 29 Aug. 1970, K. T. Richards, WAA (80845); ♀, Kanowna, 21 Aug. 1974, A. M. & M. J. Douglas, *on Mesembrion*, WAM (13892); ♂, 2♀, 17 km N Kellerberrin, 12 Sep. 1986, T. F. Houston, on flowers of *Gastrolobium*, WAM (13588–90); ♀, Lake Biddy, WAM (13714); 5♀, 7.5 km WSW Lake Cronin, 19–26 Sep. 1978, T. F. Houston, *Daviesia aphylla* & *Gastrolobium*, WAM (13618–22); ♀, 15 km S Lake King (33.2217°S 119.7147°E), 8 Oct. 2009, M. Batley, *ex Daviesia benthamii*, AM (K.344731); 11♀, 5.5–6.5 km SW McDermid Rock, 27 Sep.–3 Oct. 1978, T. F. Houston, on flowers of *Daviesia costata* & *D. aphylla*, WAM (13604–07,09,10,13–17); 5♂, ♀, Merredin, 30 Aug. 1951, C. Jenkins, WAA (80826,27,30,32,33); ♀, Moora, 21 Aug. 1940, G.F.H.J, WAA (80822); 3♂, 3♀, Mt Jackson, 5–11 Sep. 1979, T. F. Houston *et al*., on flowers of *Jacksonia compressa*, WAM (13591–92,13894–96,14013); ♂, Mullewa, September, L. J. Newman, WAA (80823); ♀, c. 2 km SW Mundaring Weir, 1 Aug. 1999, T. F. Houston, on flowers of *Daviesia decurrens*, WAM (27181); ♀, 14 km NW Narrogin (32.8761°S 117.0425°E), 9 Oct. 2009, M. Batley, AM (K.344733); ♀, 10 km S Nerren Nerren HS, 19 Aug. 1980, C. A. Howard & T. F. Houston, on flowers of *Chorizema ericifolium*, WAM (13969); ♀, 6 km W Newdegate (33.1011°S 118.9639°E), 8 Oct. 2009, M. Batley, AM (K.344732); 6♂, 11 mi N of New Norcia, 18 Aug. 1971, T. F. Houston, SAM (32-024620–25); ♀, Norseman area of Lake Cowan, 6 Sep. 1990, R. P. McMillan, WAM (13970); ♀, North Tarin Rock Reserve (32.98°S 118.23°E), 16–18 Oct. 1985, T. F. Houston, on flowers of *Gastrolobium* sp., WAM (13899); ♂, Sixty Foot Falls near Gosnells, 5 Sep. 1998, E. McCrum, WAM (19117); ♀, Southern Cross, September, L. J. Newman, WAA (80825); ♂, 2♀, Swanbourne, WAM (13708–10); ♂, Tallering Stn, Aug. 1976, R. P. McMillan, WAM (13789); 2♀, Tutanning Reserve 18–25 km E Pingelly, 30 Oct.–3 Nov. 1980, T. F. Houston, on flowers of *Daviesia brevifolia*, WAM (13897–98); 5♂, 13♀, Wamenusking, WAM (13694–99,13701–07,13762,65–68); ♂, Ynin Stn NE of Mullewa, 7 Aug. 1954, A. Snell, ANIC.

Diagnosis

Eyes hairy; metasomal bands narrow, silver; ocellar-ocular area frequently with weak coppery colour. Male gena with dense white pubescence. Female clypeus sagittally flattened; lateral epistomal suture curved; clypeus coplanar with supraclypeal area.

Descriptions

Male (holotype).—*Head* width 4.20 mm, body length 12.5 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 31, LID 30, DMA 28, HVO 4, WOC 14, MOD 3, OOD 9, IAD 7, ASD 3, AOD 9, ML 19, BMW 5, MSL 2.0, SL 12, SW 3, FL c. 47.—*Eyes* hairy; face broad, inner orbits subparallel; length malar space c. 0.3× basal mandibular width; middle flagellomeres c. 1.6× as long as wide. Legs slender; fore basitarsus short and gently bowed; hind tarsus c. 1.2× as long

as hind tibia; hind basitarsus 4.6× as long as wide; posterior carina of basitibial area reaches apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with rectangular lateral lobes, large basal teeth and posterior projections (Fig. 64).—*Labrum*, mandible medially, scape, tarsi and tibiae orange-brown; scape often with dark suffusions, occasionally entirely dark brown; tibiae with variable amounts of dark brown; flagellum brown ventrally. T1–5 with narrow silver bands, narrowly tinted brown across anterior margin; T7 reddish.—*Clypeus* densely punctate basally, apical 20% polished, impunctate. Scutum shining with moderately strong pit-reticulation and close punctures.—*Face* with dense, finely-branched, long, orange hair; gena densely covered with white plumose hair. Scutum openly covered with long, erect, plumose, pale orange hair; fore basitarsus with plume of long, minutely branched hair on proximal half; anterior margin of hind tibia with row of openly spaced, long, white hair.

Female (AM K.344732).—*Head* width 4.40 mm, body length 12.9 mm. Relative dimensions: HW 50, HL 39, UID 29, UFW 31, LID 32, DMA 30, HVO 4, WOC 13, MOD 3, OOD 8, IAD 9, ASD 3, AOD 9, ML 21, BMW 7, MSL 2.0, SL 15, SW 3, FL c. 32.—*Eyes* hairy; face broad, inner orbits divergent ventrally; malar space c. 0.3× basal mandibular width; clypeus convex, flattened sagittaly; basal suture concave; width supraclypeal area more than twice length subantennal suture; base of clypeus and supraclypeal area approximately coplanar; epistomal suture between base of clypeus and base of mandible distinctly concave; distance from anterior tentorial pit to base mandible 3× distance between pit and base of clypeus; labrum uniformly convex, length 0.6× width; middle flagellomeres c. 1.2× as long as wide; hind tibial spur with c. 9 strong teeth; tarsal claws simple; pygidial plate entire, flat or with slight medial elevation.—*Labrum*, mandible medially, tarsi, hind tibia, extremities of fore and mid tibiae, distal ends of femora orange-brown; remainder of legs and flagellum ventrally, dark brown. T1–4 with narrow silver bands, weakly stained brown across anterior margin.—*Clypeus* weakly reticulate basally, punctures large and dense medially, sparse laterally, fine and dense in apicolateral corners. Scutal sculpture as for male.—*Face* with long, plumose, white or pale orange-brown hair, sparse on clypeus and supraclypeal area, dense in paraocular areas and on frons. Scutum closely covered with moderately short, plumose, dark-tipped, dull orange hair; prepygidial fimbria dark brown; scopal hair orange-brown laterally, darker medially.

Remarks. Similar to several other species. May be distinguished from from *T. albigenae* n.sp. by the strongly protuberant clypeus and longer malar space; from *T. grandis* n.sp. by smaller size and longer malar space; from *T. capillosus* n.sp. by dense genal hair (male) and broader supraclypeal area (female); and from *T. dundasensis* n.sp. (female) by curvature of the epistomal suture and coplanarity of clypeus and supraclypeal area.

This species is referred to as F249/M223, F272/M239, F270 and F252 (part) in Houston (2000).

Etymology. The specific name is a transliteration of the Greek adjective meaning with white cheeks, referring to the dense genal hair of the male.

Distribution. Southwestern Australia (AW, COO, ESP, GS, JF, MAL, SWA, WAR, YAL) (Fig. 101).

Trichocolletes luteorufus n.sp.

Fig. 102

Type. Holotype ♀, 13 km NE Warriedar, Western Australia, 28 Aug. 1981, T. F. Houston, on flowers of *Cassia chatelainiana*, in WAM 13656.

Specimens examined. The holotype and the following. **Western Australia**: 2♀, same data as holotype, WAM (13657–58); ♀, 12 km ESE Mt Magnet, 3 Sep. 1981, T. F. Houston, on flowers of *Ptilotus obovatus*, WAM (13660).

Diagnosis

Female (male unknown) robust; eyes not hairy; metasomal bands wide, orange-gold; posterior half of metasoma with conspicuous orange hair.

Description

Female (holotype).—*Head* width 4.65 mm, body length 15.2 mm. Relative dimensions: HW 50, HL 35, UID 30, UFW 33, LID 32, DMA 29, HVO 5, WOC 14, MOD 3, OOD 9, IAD 7, ASD 4, AOD 9, ML 20, BMW 8, MSL 0.5, SL 15, SW 3, FL c. 36.—*Eyes* not hairy; face broad, inner orbits parallel; malar space short (length c. 0.1× basal mandibular width); clypeus gently convex; middle flagellomeres c. 1.2× as long as wide; inner hind tibial spur with c. 7 strong teeth; tarsal claws with large inner ramus; pygidial plate broad, entire with coarse sculpture.—*Labrum*, mandible, anterior faces of fore femur and tibia orange-brown; remainder of legs dark brown. T1–4 with wide, deep gold bands.—*Clypeus* reticulate, densely covered with large punctures; supraclypeal area with smaller, contiguous punctures.—*Face* with long, white plumose hair, becoming pale orange on frons, close on clypeus and supraclypeal area, dense in paraocular areas and on frons; vertex with long, plumose, pale orange hair. Scutum closely to densely covered with tightly branched, pale orange hair with dark brown tips; metasomal terga with open covering of short, semierect, bright orange-gold hair progressively longer and denser posteriorly; prepygidial fimbria bright orange-gold; hind tibial scopa dark brown.

Remarks. This species is referred to as F253 in Houston (2000).

Etymology. The specific name is a Latin adjective referring to the bright orange colour of the female metasoma.

Distribution. Known from two locations in Western Australia near Mount Magnet (MUR, YAL) (Fig. 102).

Trichocolletes macrognathus n.sp.

Figs 16–18, 35, 65, 103

Type. Holotype ♂, 13 km S Wanoo, Western Australia [26.49S, 114.37E], 24–28 Aug. 1984, T. F. Houston & B. P. Hanich, on flowers of *Baeckea*, in WAM 13671. The co-ordinates on the label refer to the location of Wanoo at 26°49'S 114°37'E.

Specimens examined. The holotype and the following. **Western Australia**: ♀, 11 km ENE Anketell, 4–6 Sep. 1981, T. F. Houston, *on flowers of Cassia phyllodinea* or *charlesiana*, WAM (13659); ♂, Denham-Hamelin Rd NW

Tamala turnoff, 28 Aug. 1997, T. F. Houston & P. Mathiasen, on flowers of *Malleostemon roseus*, WAM (13680); 4♂, ♀, East Yuna Reserve, 34 km WNW Mullewa, 16–29 Aug. 1984, T. F. Houston & B. P. Hanich, on flowers of *Thryptomene hyporhytis*, WAM (13673–77); 3♀, 10 mi E of Meekatharra, 31 Aug. 1971, T. F. Houston, SAM (32-024663–65); 2♀, 8 km N Nerren Nerren HS, 25 Aug. 1985, R. P. McMillan, on *Prostanthera wilkeana*, WAM (13678–79); 3♂, 9♀, 13 km S Wanoo, 24–28 Aug. 1984, T. F. Houston & B. P. Hanich, on flowers of *Baeckea* & burrowing into walls of freshly dug pit in sand, WAM (13661–70,72).

Diagnosis

Eyes not hairy; metasomal bands wide, gold; malar space very long. Male S3 with distinctive hair plume. Female scutum with transverse band of dark hair. Unlike any other species.

Descriptions

Male (WAM 21597).—*Head* width 4.35 mm, body length 12.0 mm. Relative dimensions: HW 50, HL 39, UID 36, UFW 35, LID 32, DMA 22, HVO 5, WOC 15, MOD 4, OOD 10, IAD 10, ASD 3, AOD 8, ML 20, BMW 6, MSL 7.5, SL 13, SW 3, FL c. 59.—*Eyes* not hairy, much shortened leaving malar area almost twice as long as wide (Fig. 17); flagellum longer than head width; all flagellomeres c. 1.5× as long as wide. Legs slender; hind tarsus 1.3× as long as hind tibia; hind basitarsus 5.4× as long as wide; posterior carina of basitibial area extends past apex. Gonoforceps transversely truncate with long apical hairs (Fig. 35); lateral lobes of S7 fused with posterior projections and basal teeth (Fig. 65).—*Mandible*, scape, tarsi, fore and hind tibiae, anterior faces of mid tibia and all femora, flagellomeres F2–8 ventrally, orange-brown; remainder of flagellum brown. T1–5 with wide, deep gold bands; T7, S6 laterally, orange-brown.—*Scutum* with dull sheen and moderately strong pit-reticulation. Scutum closely and face densely covered with bright orange hair, erect on clypeus, fore basitarsus with brush of relatively short golden hair; S3 with dense medial plume of long white hair (Fig. 18).

Female (WAM 13661).—*Head* width 4.85 mm, body length 13.6 mm. Relative dimensions: HW 50, HL 37, UID 31, UFW 34, LID 32, DMA 27, HVO 4, WOC 14, MOD 3, OOD 9, IAD 8, ASD 3, AOD 10, ML 19, BMW 8, MSL 5.0, SL 13, SW 3, FL c. 36.—*Eyes* not hairy; face quadrate; length malar space c. 0.7× basal mandibular width (Fig. 16); clypeus uniformly convex transversely; middle flagellomeres c. 1.5× as long as wide; inner hind tibial spur with c. 5 well-spaced teeth; tarsal claws with sharp inner ramus about half length of outer; pygidial plate broad with truncate, upturned margin.—*Mandible* medially orange-brown; legs dark brown. T1–4 with wide, bright gold bands.—*Clypeus* polished with open to close large punctures; scutum polished with close punctures.—*Lower face* with long, plumose, white hair, dense in paraocular areas, sparse to open on clypeus and supraclypeal area; frons densely covered with plumose, orange-brown hair, darker towards ocelli. Scutum covered with close to dense, plumose hair, anterior 20% and thin line around lateral and posterior margins pale orange-brown, remainder dark brown; semi-erect hair on terga strongly reflective giving metasoma a golden sheen, more pronounced apically.

Remarks. This species is referred to as F247/M220 in Houston (2000).

Etymology. The specific name, used as a noun in apposition, is derived from the Greek words for large and jaw, referring to the greatly elongated malar space of this species.

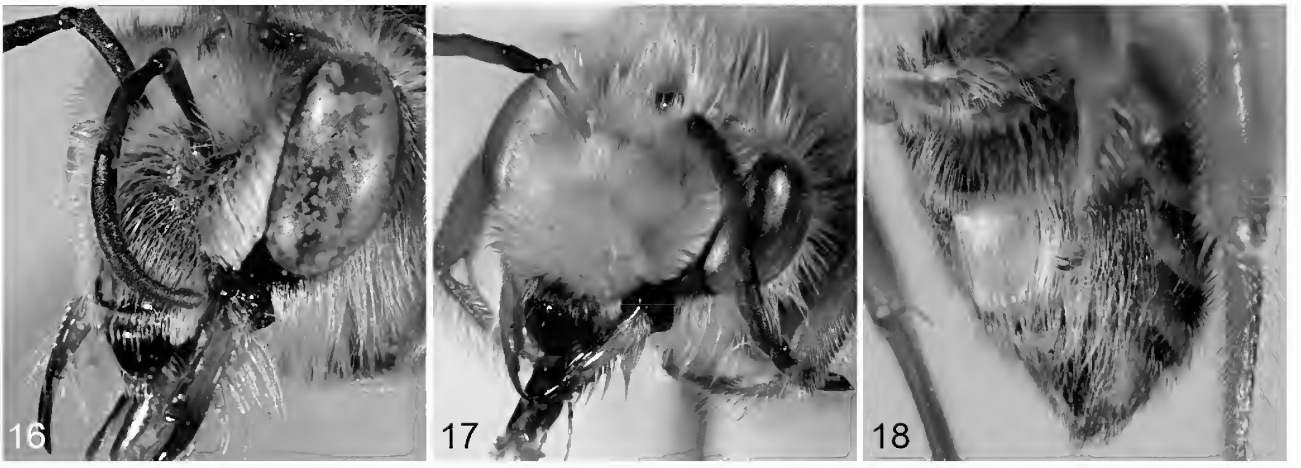
Distribution. Area around Geraldton, Western Australia (CAR, GS, MUR, YAL) (Fig. 103).

Trichocolletes marginatus (Smith)

Figs 19, 36, 66, 104

Paracolletes marginatus Smith, 1879, p. 4.
Trichocolletes (Trichocolletes) marginatus Michener, 1965, p. 80.

Specimens examined. The lectotype ♂, Australia, BMNH (Hym 17.a.417) and the following. **Western Australia**: ♂, Albany, 9 Nov. 1981, B. L. Dickenson, WAM (13904); ♀, Albany, L. J. Newman, WAA (80829); 2♀, Albany, 18 Nov. 1991, H. T. Mattner, WAM (13900–01); 8♂, Calgardup, WAM (13747–54); ♀, Cape Freycinet, 15–18 Nov. 1986, T. F. Houston, WAM (13903); 2♂, Denmark, WAA (45282–83); 12♂, Elleker near Albany (35.0167°S 115.9500°E), 1 Nov. 1998, A. Ferguson, WAM (21954–65); ♀, Margaret River, 29 Dec. 1970, G. A. Holloway, AM (K.316700); ♂, 25 km NE Nannup (33.8167°S 115.9500°E), 25 Nov. 1989, P. Jones, WAM



Figs 16–18. *Trichocolletes macrognathus* n.sp.: head showing long malar area of (16) female, (17) male; (18) ventral view of male metasoma, showing plume on S3.

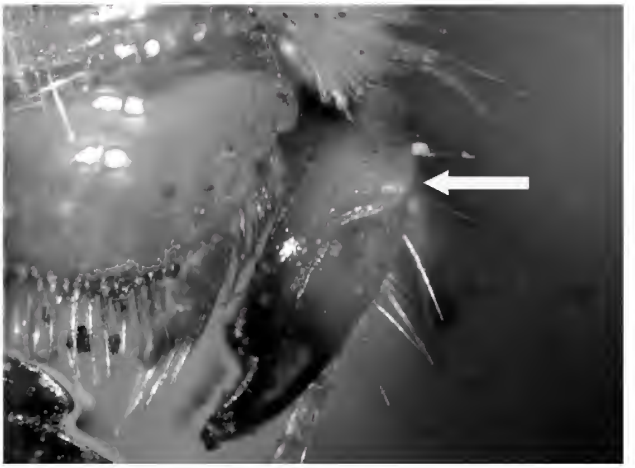


Fig. 19. *Trichocolletes marginatus* left mandible of male with horizontal projection arrowed.

(18565–67); 5♂, Pemberton, 24 Nov. 1958, W. Napier, WAA (45292–96); ♀, West Midland, 12 Nov. 1950, MV (16514); 2♀, West Midland (31.8833°S 115.9833°E), 26 Oct. 1952, MV (16526,30); ♀, 14 km WSW Witchcliffe, 14 Nov. 1986, T. F. Houston, on flowers of *Jacksonia*, WAM (13902); 2♂, 2♀, Yallingup, WAM (13755–58); ♂, Yallingup, 16 Nov. 1968, N. McFarland, SAM (32-024666).

Diagnosis

Length 15–16 mm; eyes not hairy; metasomal bands narrow, gold or silver; upper margin of mandible with horizontal projection, more pronounced in male. Male mid and hind tibiae incrassate; flagellum longer than head width; S2 with large, untidy hair tuft.

Descriptions

Male (WAM 21957).—*Head* width 4.70 mm, body length 16.0 mm. Relative dimensions: HW 50, HL 37, UID 28, UFW 29, LID 32, DMA 30, HVO 6, WOC 13, MOD 4, OOD 8, IAD 8, ASD 4, AOD 8, ML 19, BMW 9, MSL 1, SL 13, SW 3, FL c. 56.—*Eyes* not hairy; head broad; inner orbits divergent ventrally; malar space very short; clypeus strongly protuberant; basal ⅔ mandible with horizontal projection from upper margin (Fig. 19); flagellum longer than head width, middle flagellomeres c. 1.6× as long as wide. Legs stout; mid tibia strongly swollen; hind tibia less so, concave on inner surface; length hind tarsus subequal to length hind tibia; hind basitarsus 3.7× as long as wide; basitibial area acarinate. Genital capsule (Fig. 36) somewhat like that for *T. orientalis* n.sp., but with larger projection on inner surface of gonoforceps; S7 with rectangular lateral lobes, very long posterior projections and small basal teeth (Fig. 66).—*Labrum* cream; ventral margin of clypeus yellow-brown; mandible medially amber; scape, tibiae, tarsi, anterior face fore femur, distal ends of mid and hind femora and flagellomeres F1–4 ventrally, orange-brown; remainder of flagellum dark brown. T1–5 with gold or silver bands, narrowly stained brown across anterior margin; wings darkened.—*Face* covered with long, plumose, orange hair, close and stiffly erect on the clypeus, dense elsewhere. Scutum closely covered with long, erect, finely-branched orange hair; fore basitarsus with tapered plume of long, orange hair; fore trochanter and femur with thin cover of long orange hair; anterior margin hind basitarsus and distal half hind tibia with sparse, long, orange hair.

Female (AM K.316700).—*Head* width 4.90 mm, body length 15.3 mm. Relative dimensions: HW 50, HL 36, UID 26, UFW 31, LID 32, DMA 30, HVO 5, WOC 11, MOD 3, OOD 7, IAD 8, ASD 3, AOD 9, ML 19, BMW 8, MSL 0.5, SL 15, SW 3, FL c. 34.—*Eyes* not hairy; head broad; inner orbits divergent ventrally; malar space very short; mandibular projection less prominent than for male; clypeus transversely convex; inner hind tibial spur with c. 9 long teeth, outer spur pectinate; tarsal claws simple.—*Ventral* margin of clypeus medially, distitarsi orange-brown; legs dark brown. T1–4 with narrow gold or silver bands.—*Clypeus* weakly reticulate with large punctures, dense basally, open apically; supraclypeal area with punctures coalescing into irregular vertical channels; scutum and metasoma with dull sheen.—*Face* with long, white, plumose hair, dense in paraocular areas and on frons, open on supraclypeal area and dorsolateral margins of clypeus. Scutum densely covered with short, finely-branched, dark-tipped pale brown hair; hind tibial scopa dark brown with paler hair on anterior margin; prepygidial fimbria dark brown to black.

Remarks. In his original description, Smith reported that his specimens came from Queensland, leading Cockerell (1913a, 1914) to apply the name *T. marginatus* to the species here named *T. serotinus* n.sp.. As pointed out by Michener (1965), this has led to the misidentification of many specimens of *T. serotinus* n.sp. in Australian collections.

This species is referred to as F259/M231 in Houston (2000).

Distribution. Coastal southwestern Australia (JF, SWA, WAR) (Fig. 104).

Trichocolletes maximus (Cockerell)

Figs 10, 20, 24, 67, 105

Paracolletes maximus Cockerell, 1929b, p. 9 (female).
Trichocolletes (Trichocolletes) maximus.—Michener, 1965, p. 80.

Specimens examined. New South Wales: 6♀, 7 km W Walgett, 15 Sep. 1988, N. W. Rodd, *ex Swainsona procumbens*, AM (K.316701–06); 3♀, 10 km N Mungindi (28.9108°S 148.9461°E), 25 Aug. 2007, M. Batley, *ex Swainsona procumbens*, AM (K.316524–25, 31); 3♂, 2♀, 32 km NNW Mungindi (28.7092°S 148.8825°E), 25 Aug. 2007, M. Batley, *ex Swainsona procumbens*, AM (K.316526–30); ♀, 5 km E Condobolin (33.0770°S 147.1975°E), 26 Sep. 2010, M. Batley, *ex Swainsona procumbens*, AM (K.316532). **Victoria**: 2♀, Ellmore-Mitiano Road (36.2920°S 144.3130°E), 2009, A. H. Murphy, *ex Swainsona procumbens*, AM (K.316708–09); ♂, Terrick Terrick NP, (36.0920°S 144.2620°E), 24 Aug. 2009, A. H. Murphy, *ex Swainsona procumbens*, AM (K.316707).

Diagnosis

Length 13–14 mm; eyes hairy; scutal hair dense, ferruginous; metasomal bands silver-white; labrum black or dark brown; scape black in both sexes. Female clypeus weakly protuberant.

Descriptions

Male (AM K.316525), not previously described.—*Head* width 4.65 mm, body length 12.6 mm. Relative dimensions: HW 50, HL 35, UID 33, UFW 34, LID 31, DMA 29, HVO 7, WOC 13, MOD 3, OOD 10, IAD 9, ASD 3, AOD 9, ML 20, BMW 7, MSL 0.8, SL 16, SW 3, FL c. 46.—*Eyes* hairy; inner orbits ventrally convergent; length malar space c. 0.15× basal mandibular width; gena broad, almost as wide as eye viewed laterally; middle flagellomeres c. 1.5× as long as wide; hind tibia with angular, densely setose ridge from basitibial area to distal margin; hind tarsus as long as hind tibia; hind basitarsus 3.8× as long as wide; hind basitibial area with posterior carina to apex (Fig. 24). Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with rectangular lateral lobes and short posterior projections (Fig. 67). Distitarsi and flagellomeres F2–6 ventrally, orange-brown; mandible medially, dark brown. T1–5 with silver bands.—*Vertex* and scutum noticeably dull with strong pit-reticulation.—*Face* densely covered with long, erect, plumose, orange hair; gena closely covered with long, white hair. Scutum closely to densely covered with long, plumose, ferruginous hair; fore basitarsus and all trochanters with long plumes of white hair; anterior margin of hind tibia with fringe of close, long, white hair. T1,2 openly covered with long, erect, white hair, shorter on T2; T3–6 openly covered with short, semi-adpressed hair mostly matching underlying integument, but with some pale hair extending onto dark areas anterior to silver bands.

Female (AM K.316527).—*Head* width 4.90 mm, body length 13.8 mm. Relative dimensions: HW 50, HL 37, UID 32, UFW 34, LID 33, DMA 34, HVO 4, WOC 14, MOD 3, OOD 10, IAD 8, ASD 3, AOD 10, ML 20, BMW 9, MSL 1.5, SL 16, SW 3, FL c. 29.—*Face* broad; inner orbits subparallel; malar space short (length c. 0.2× basal mandibular width); gena about 2/3 as wide as eye, viewed laterally; vertex elevated; clypeus transversely convex laterally, but strongly flattened medially; middle flagellomeres c. 1.3× as long as wide; inner hind tibial spur with c. 6 strong teeth; basitibial area not elevated above surroundings (Fig. 20); tarsal claws simple; pygidial plate entire, without medial elevation, strongly sculptured.—*Labrum*, mandible medially dark brown; distitarsi orange-brown. T1–4 with narrow silver-white bands.—*Clypeus* and paraocular areas reticulate, closely punctate; supraclypeal punctures contiguous, merging to form irregular grooves.—*Clypeus* sparsely covered with long, finely-branched, white hair; paraocular areas and frons densely covered with long, plumose hair, white below antennal sockets, becoming pale orange above.—*Scutum* densely covered with short, erect, finely-plumose, bright ferruginous hair; hind tibial scopa white except dark brown near basitibial area; pubescence of metasomal terga as for male; prepygidial fimbria off-white or pale brown.

Remarks. In Cockerell's original description, it is clear from references to the pygidial plate and hind tibial scopa that he was describing a female, but erroneously reported that it was male. Dr Ascher of the American Museum of Natural History provided photographs of the holotype and has confirmed that the holotype is female and has the diagnostic features described above.

Distribution. Inland areas from southern Queensland to northern Victoria (DRP, NSS, RIV) (Fig. 105).

Trichocolletes micans n.sp.

Figs 68, 106

Type. Holotype ♂, Kinchega NP, New South Wales (32.4581°S 142.3525°E), 8 Sep. 2007, M. Batley, *ex Swainsona purpurea*, in AM K.344736.

Specimens examined. The holotype and the following. **New South Wales**: ♂, 5♀, same data as holotype, AM (K.344737–42); 4♂, Black Mountain, Gunnedah (31.0280°S 150.1346°E), ANIC; 2♂, 9♀, 3 mi E Legume, 25 Sep. 1964, T. F. Houston, SAM (32-024512–22); 7♂, 7♀, 6 km S Mungindi, 15 Sep. 1988, N. W. Rodd, AM (K.344441–53, K.316710). **Queensland**: ♀, 30 km N Mungindi (28.7586°S 148.8950°E), 14 Sep. 2005, M. Batley, *ex Swainsona* sp., AM (K.344735). **South Australia**: 2♀, 50 km S Leigh Creek, 18 Sep. 2010, M. Edwards, SAM.

Diagnosis

Length c. 11 mm; eyes hairy; scape black in both sexes; legs black; metasoma sericeous with moderately wide, silver-white bands, ferruginous across anterior margins; known only from eastern Australia.

Descriptions

Male.—*Head* width 3.75 mm, body length 11.0 mm. Relative dimensions: HW 50, HL 37, UID 31, UFW 32, LID 30, DMA 30, HVO 4, WOC 15, MOD 4, OOD 8, IAD 9, ASD 3, AOD 9, ML 20, BMW 8, MSL 2.0, SL 14, SW 3, FL c. 48.—*Eyes* hairy; face almost quadrate, inner orbits parallel; length of malar area c. 0.25× basal mandibular width; flagellum slightly shorter than head width, middle flagellomeres c. 1.6× as long as wide. Legs slender; length hind tarsus equal to length hind tibia; hind basitarsus 4.3× as long as wide; basitibial area with strong posterior carina to apex and sharp edge on anterior margin. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 with narrow rectangular lateral lobes and strong posterior projections (Fig. 68). Distitarsi and mandible medially orange-brown; labrum dark brown. T1–5 with broad, silver-white bands, ferruginous across anterior third.—*Clypeus*, other than apical margin, densely punctate with interspaces except basally, where a few punctures coalesce; scutum with dull sheen, moderately strong pit-reticulation and close small punctures.—*Face* with dense, long, finely-branched, white hair. Scutum closely covered with long, branched, white or pale brown hair; anterior margin of hind tibia with close fringe of long, white hair; metasomal terga with short, semi-adpressed, translucent hair, conspicuous only when illuminated obliquely.

Female.—*Head* width 3.90 mm, body length 11.6 mm. Relative dimensions: HW 50, HL 36, UID 31, UFW 33, LID 32, DMA 33, HVO 4, WOC 15, MOD 4, OOD 7, IAD 9, ASD 3, AOD 10, ML 20, BMW 7, MSL 1.5, SL 15, SW 3, FL c. 31.—*Face* wider than long, inner orbits diverging ventrally; length malar space c. 0.2× basal mandibular width; clypeus gently convex transversely; middle flagellomeres c. 1.1× as long as wide; inner hind tibial spur with c. 8 teeth; basitibial area with anterior and posterior carinae and apex elevated above surroundings; only hind tarsal claw with small inner ramus; pygidial plate with small emargination and slight medial elevation. Distitarsi orange-brown; remainder of legs and mandible dark brown; labrum dark brown or black, rarely suffused with orange-brown. T1–4 with broad, silver-white bands

ferruginous across anterior third.—*Clypeus* densely punctate on a strongly reticulate ground; scutal sculpture as for male.—*Face* covered with long, plumose, white hair, dense on frons and in paraocular areas, close on clypeus and supraclypeal area. Scutum closely covered with moderately short, plumose, pale brown hair; scopal hair off-white; golden brown setae in basitibial area; metasoma sericeus as for male; fimbria light brown.

Remarks. Similar to *T. brunilabrum* n.sp. and *T. lacaris* n.sp., from which males may be distinguished by the shape of S7. Females differ from *T. brunilabrum* n.sp. by the finer clypeal sculpture and from *T. lacaris* n.sp. by the presence of an inner ramus on hind tarsal claw. This species is superficially similar to *T. tuberatus* n.sp., with which it may be sympatric, but is easily distinguished by its smooth labrum.

Etymology. The specific name is a Latin adjective meaning glittering, referring to the metasoma which is conspicuously reflective when the insects forage in direct sunlight.

Distribution. Inland New South Wales and South Australia (BBS, DRP, FLB, SEQ) (Fig. 106).

Trichocolletes multipectinatus Houston

Fig. 107

Trichocolletes (Trichocolletes) multipectinatus Houston, 1990, p. 618.

Diagnosis

Eyes not hairy; proboscis relatively elongate, prementum length at least 3.5× eye width viewed laterally. Female lower clypeus dull, densely punctate; facial hair brown, simple; mid-tibial spur strongly curved with set of stout teeth medially; prepygidial fimbria orange or mostly so. Male with hair of clypeus very erect, of even length, appearing cropped; fore basitarsus expanded ventrally; fore calcar without teeth; T7 with only a medial spot yellow-brown.

Remarks. Exhibits a preference for flowers of *Eremophila*. Detailed descriptions can be found in Houston (1990). A more recently collected specimen (♀, Wilcannia [31.6742°S 143.4664°E], 28 Sep. 2003, M. Batley, *ex Eremophila sturtii*, AM [K.316532]) extends the known range eastward.

Distribution. Southern Western Australia (Mt Magnet – Kalgoorlie region), northern Eyre Peninsula, South Australia and western New South Wales (COO, DRP, GAW, MUR, YAL) (Fig. 107).

Trichocolletes nitens n.sp.

Figs 13, 69, 108

Type. Holotype ♂, 5.5–6.5 km SW McDermid Rock, Western Australia, 27 Sep.–3 Oct. 1978, T. F. Houston, on flowers of *Daviesia aphylla*, in WAM 13800.

Specimens examined. The holotype and the following. **Western Australia**: ♀, 10 km NE Kulin (32.6014°S 118.2158°E), 10 Oct. 2009, M. Batley, *ex Gastrolobium* sp., AM; 3♂, 7♀, 5.5–6.5 km SW McDermid Rock, 27 Sep.–3 Oct. 1978, T. F. Houston, on flowers of *Daviesia aphylla* & *Leptospermum erubescens*, WAM (13800–10); 6♀, Merredin, WAM (13509,10,13778–81); 2♀, Merredin (31.4594°S 118.3169°E), 19 Oct. 2009, M. Batley, *ex Gastrolobium* sp., AM (K.344745); ♀, Minnivale, WAM (13811); ♂, ♀, 6 km W Newdegate (33.1011°S 118.9639°E), 8 Oct. 2009, M. Batley, *ex Gastrolobium ilicifolium*, AM; ♂, ♀, 15 km N Westonia (31.1981°S 118.7586°E), 19 Sep. 2004, M. Batley, *ex Gastrolobium* sp., AM (K.344743–44); 2♂, ♀, Yelbeni, Sep., B. O'Connor, WAA (45277–78, 45303).

Diagnosis

Dark-coloured; eyes not hairy; metasomal bands wide, orange-gold. Male fore trochanter with blunt projection; mid femur incrassate. Female scutal hair dark brown; hind tibial scopa dark brown; hind tarsal claw simple.

Descriptions

Male—*Head* width 4.00 mm, body length 12.6 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 39, LID 30, DMA 30, HVO 2, WOC 14, MOD 4, OOD 8, IAD 8, ASD 3, AOD 7, ML 18, BMW 6, MSL 0.5, SL 13, SW 3, FL c. 50.—*Eyes* not hairy; face narrow; malar space short (length c. 0.1× basal mandibular width); flagellomeres c. 1.5× as long as wide. Legs slender; fore trochanter with triangular ventral projection; mid femur incrassate; hind tarsus as long as hind tibia; hind basitarsus 3.5× as long as wide. Genital capsule generally like that for *T. orientalis* n.sp. (Fig. 37); S7 (K.344743) with long, thin posterior projections and ligulate processes, rectangular lateral lobes with sinuate posterior marg in (Fig. 69).—*Labrum*, mandible and rim of clypeus amber; scape, tarsi, tibiae and femoral apices orange-brown; remainder of legs dark brown; flagellum brown, paler ventrally. T1–5 with wide, bright gold bands; T7 dull orange-brown.—*Clypeus* densely punctate; scutum with weak pit-reticulation, dull sheen and dense, small punctures.—*Face* densely covered with bright orange hair, stiffly erect on clypeus. Scutum closely covered with long, plumose orange hair; fore basitarsus with dense plume of long golden hair; hind femur with sparse fringe long hair on anterior margin; mid basitarsus with conspicuous brush of erect golden hair on anterior margin; metasoma sericeous with semi-adpressed golden pubescence.

Female (AM K.344744).—*Head* width 4.35 mm, body length 12.9 mm. Relative dimensions: HW 50, HL 37, UID 29, UFW 31, LID 30, DMA 27, HVO 2, WOC 13, MOD 3, OOD 8, IAD 13, ASD 3, AOD 9, ML 20, BMW 6, MSL 0.5, SL 14, SW 3, FL c. 31.—*Eyes* not hairy; inner orbits parallel; malar space short (length c. 0.1× basal mandibular width); clypeus transversely convex; middle flagellomeres as long as wide; inner hind tibial spur with c. 7 long, well-spaced teeth; tarsal claws simple; pygidial plate entire with broad medial elevation.—*Rim of clypeus* amber; labrum and mandible orange-brown; legs dark brown. T1–4 with wide, deep gold bands.—*Clypeus* polished apically, increasingly reticulate basally, with large punctures, sparse apically becoming close basally; scutal sculpture as for male.—*Face* with long white, plumose hair, becoming pale orange near ocelli,

dense in paraocular areas and on frons, sparse on clypeus and supraclypeal area. Scutum densely covered with short, plumose, brown hair, tipped with dark brown; metasoma sericeous with semi-adpressed golden pubescence; tibial scopa dark brown; prepygidial fimbria orange-gold.

Remarks. This species can usually be distinguished from *T. centralis* n.sp. by its darker colouration, but males also have features not found in *T. centralis* n.sp.: a projection on the fore trochanter, and mid femur incrassate and a conspicuous brush on the anterior margin the mid basitarsus. Females differ from *T. centralis* n.sp. mostly by colour but also by the simple hind tarsal claw.

This species is referred to as F256/M230 in Houston (2000).

Distribution. Inland parts of southwestern Australia (AW, MAL, COO) (Fig. 108).

Etymology. The specific name is a Latin adjective meaning brilliant or beautiful, referring to the conspicuous bright gold metasomal bands.

Trichocolletes orientalis n.sp.

Figs 37, 70, 109

Type. Holotype ♂, Wollar, New South Wales (32.3608°S 149.9214°E), 10 Sep. 2005, M. Batley, *ex Hardenbergia violacea*, in AM K.278553.

Specimens examined. The holotype and the following. **Australian Capital Territory**: 3♂, Black Mountain (35.2633°S 149.0875°E), 1 Oct. 2006, M. Batley, *ex Daviesia mimosoides* & *Hardenbergia violacea*, AM (K.334782–84); 2♂, 3♀, Black Mtn, 1 Nov. 1968, T. F. Houston, on *Daviesia mimosoides, Daviesia acicularis* & *Pultenaea procumbens*, UQIC. **New South Wales**: 3♂, same data as holotype, AM (K.334767–69); ♂, Austinmer, 1 Dec. 1951, Butcher, AM (K.344470); ♀, Bargo (34.2833°S 150.5833°E), 4 Oct. 2000, M. Batley, *ex Pultenaea villosa*, AM (K.334753); ♂, Bilpin (33.4814°S 150.5480°E), 9 Sep. 2005, M. Batley, *ex Daviesia mimosoides*, AM (K.334766); 4♂, Bilpin, 21 Sep. 1978, N. W. Rodd, AM (K.344475–78); 4♂, 6 km N Bilpin, 3 Aug. 1979, N. W. Rodd, AM (K.344482–86); 3♂, 6 km N Bilpin, 11–23 Aug. 1977, N. W. Rodd, AM (K.344472–74); 3♂, 6 km NE Bilpin, 23 Sep. 1992, N. W. Rodd, AM (K.344527–29); 2♂, ♀, 15 km NW Boorowa (34.3028°S 148.6708°E), 2 Oct. 2006, M. Batley, *ex Hardenbergia violacea*, AM (K.334785–87); 2♂, 15 km N Bulahdelah, 20 Aug. 1982, N. W. Rodd, AM (K.344494–95); ♀, Cheltenham, 14 Oct. 1951, AM (K.344469); ♀, Cheltenham, 22 Oct. 1949, AM (K.344464); 3♂, ♀, Cheltenham, 27 Aug. 1950, AM (K.344465–68); ♂, ♀, Commodore Heights (33.5936°S 151.2978°E), 11 Aug. 2006, M. Batley, *ex Hardenbergia violacea*, AM (K.334778–79); 10♂, 34 km NNE Coonabarrabran, 17 Sep. 1989, A. Sundholm & J. Bugeja, AM (K.344517–26); ♀, Cowan, 30 Aug. 1947, AM (K.344461); 3♂, Doyles Creek (32.5220°S 150.7972°E), 19–22 Aug. 2005, M. Batley, *ex Daviesia genistifolia*, AM (K.224613, K.334761); ♀, 30 km S Dubbo, 12 Nov. 1984, N. W. Rodd, AM (K.344497); ♀, Dundas, 12 Aug. 1945, AM (K.344458); ♂, 9 km NW Dunedoo (31.9489°S 149.3230°E), 3 Sep. 2006, M. Batley, AM (K.334781); ♂, Heathcote (34.0800°S 151.0222°E), 10 Aug. 2001, M. Batley, *ex Monotoca scoparia*, AM (K.334755); ♀, Kentlyn (34.0475°S 150.8842°E), 8 Sep. 2000, M. Batley, *ex Daviesia acicularis*, AM (K.334752); 2♀, Kentlyn (34.0475°S 150.8842°E), 31 Aug. 1999, M. Batley, *ex Hardenbergia violacea*, AM (K.334752); ♀, Lane Cove, 2 Sep. 1944, AM (K.344457); ♂, Lane Cove, 5 Sep. 1948, AM (K.344462); ♀, Lane Cove, 7 Oct. 1944, AM (K.344457); 2♂, Lane Cove, 27–30 Jul. 1944, AM (K.344454–55); 2♂, 2♀, Marramarra NP (33.5694°S 151.1272°E), 3–24 Aug. 2001, M. Batley, *ex Boronia ledifolia, Dillwynia retorta* & *Hardenbergia violacea*, AM (K.224182–83, K.334754, 56); ♀, Mellong Swamp, 18 Oct. 2002, J. Indsto, *ex Dillwynia glaberrima*, AM (K.224812); ♀, Mt Kuringai, 12 Sep. 1948, AM (K.344463); 5♂, Mullion Flora Res. (33.11°S 149.17°E), 1 Oct. 2005, M. Batley, *ex Dillwynia* sp., AM (K.334773–77); ♂, ♀, Munmorah SRA, 8–27 Aug. 2003, J. Indsto, *ex Hardenbergia violacea*, AM (K.224813,23); 2♂, 2♀, Nadgee Reserve, 6 Sep. 1985, R. W. Thorp, *ex Daviesia* sp., AM (K.344498–501); ♀, Nadgee Reserve, 12 Oct. 1986, E.A Sugden, *ex Dillwynia sericea*, AM (K.344502); ♂, National Park, 10 Sep. 1955, D. K. McAlpine, AM (K.344471); 3♀, 5 km N Nullo Mtn turnoff, 21 Nov. 1978, N. W. Rodd, AM (K.344479–81); 2♂, North Ryde (33.7644°S 151.1055°E), 30 Aug. 2005, M. Batley, *ex Dillwynia retorta*, AM (K.334764–65); 3♀, Parramatta Park (33.7914°S 150.0100°E), 18 Aug. 1999, M. Batley, *ex Daviesia ulicifolia*, AM (K.334746–47,51); 2♂, 2♀, Parramatta Park, 14 Aug. 2009, M. Batley, AM (K.334800–02); ♂, Pearl Beach, C. Morris, AM (K.344530); ♂, Pennant Hills (33.7494°S 151.0878°E), 3 Sep. 1999, M. Batley, *ex Pultenaea stipularis*, AM (K.334750); 3♀, Pilliga NR (30.9364°S 149.4222°E), 13 Sep. 2005, M. Batley, *ex Pultenaea cinerascens*, AM (K.334770–72); 5♂, 6♀, Scheyville NP, 13–30 Aug. 2001, J. Indsto, *ex Hardenbergia violacea*, AM (K.224745–55); 5♂, 2♀, Scheyville NP, 30 Aug.–8 Sep. 2002, J. Indsto, AM (K.224786–89,92–94); ♀, Smithfield, 10 Aug. 1947, S. Stein, AM (K.344460); ♂, 2♀, Tomaree NP, 11–20 Sep. 2003, J. Indsto, *ex Hardenbergia violacea*, AM (K.224802,43,44); ♀, Turramurra (33.6864°S 151.1600°E), 30 Jul. 2004, M. Batley, *ex Boronia ledifolia*, AM (K.334760); 2♂, Turramurra (33.6864°S 151.1600°E), 29 Aug. 2005, M. Batley, *ex Dillwynia retorta*, AM (K.334762–63); ♂, 6 km SW Wyee, 19 Aug. 2005, M. Batley, *ex Daviesia squarrosa*, AM (K.224608). **Queensland**: 11♂, 5♀, Acacia Ridge, 21 Aug. 1966, T. F. Houston, on *Daviesia*, Hairy bush pea & False *Sarsparilla*, SAM (32-024457,61–64,66–75); ♂, ♀, Beerburrum, 7 Sep. 1991, G. Maynard, off *Daviesia*, MV; ♀, 14 km W Beerburrum (26.9420°S 152.8303°E), 25 Aug. 2008, M. Batley, AM (K.334793); 3♂, 7♀, Beerwah, 2–17 Sep. 1966, J. C. Cardale, *Daviesia*, UQIC; 2♂, Brisbane, 4 Sep. 1911, H. Hacker, QM; ♀, Brisbane, 13 Sep. 1921, H. Hacker, QM; Brisbane, 29 Aug. 1916, H. Hacker, QM; 3♂, Brisbane, 20 Aug. 1918, H. Hacker, QM; ♂, Brisbane, 14 Aug. 1966, F. R. Wylie, UQIC; 4♂, Brisbane, 19 Aug. 1956, K., J., MV (16556–59); ♀, Cooloola, 17–28 Aug. 1970, E. C. Dahms, QM; 2♂, S of Eukey, 26 Sep. 1967, T. F. Houston, *Daviesia and Hardenbergia*, SAM (32-024501, 03); 6♂, Glen Aplin, 11 Sep. 1966, J. C. Cardale, UQIC; ♂, ♀, Karawatha (27.6658°S 153.1072°E), 31 Aug. 2008, M. Batley, *ex Daviesia ulicifolia*, AM (K.334795–96); ♂, 5 mi S Mooloolaba, 10 Sep. 1968, T. F. Houston, on *Daviesia*, SAM (32-024460); ♂, Mount Coot-tha (27.5083°S 152.9625°E), 29 Aug. 2008, M. Batley, *ex Pultenaea villosa*, AM (K.334794); ♀, Redland Bay, 3 Sep. 1950, MV (16518); ♂, Redland Bay, 24 Aug. 1966, T. F. Houston, *Hairy bush pea*, SAM (32-024465); ♂, ♀, 69 km E St George (28.0308°S 149.3486°E), 24 Aug. 2008, M. Batley, *ex Leucopogon biflorus*, AM (K.334788–89); ♂, Tibrogargan, 15 Aug. 1966, T. F. Houston, SAM (32-024455); 3♀, Tin Can Bay, 4 Oct. 1987, N. W. Rodd, AM (K.344514–16); 4♂, 7♀, Tin Can Bay, 23–29 Aug. 1986, N. W. Rodd, AM (K.344503–13). **South Australia**: 3♀, Kangaroo Island (35.7869°S 136.8969°E), 21–22 Nov. 2002, M. Batley, *ex Dillwynia* sp., AM (K.334757–59); 3♂, 5 km E Hartley, 8 Sep. 1975, C. & T. F. Houston, on *Daviesia brevifolia*, SAM (32-024609–11); 4♂, 8 mi S Kingscote Kangaroo Is, 1 Oct. 1970, T. F. Houston, on *Dillwynia floribunda*, SAM (32-024600–03); ♂, Mt Lofty sum, T.F.H., *Daviesia*, SAM (32-024476); 5♂, Rocky River, Kangaroo Is, 4 Oct. 1970, T. F. Houston, on *Swainsona lessertiifolia* & *Leucopogon*, SAM (32-024604–08); ♂, Bendigo, 10 Sep. 1922, Burns, Alec N., MV (16527); ♂, Heathmont, 23 Aug. 1930, Burns, Alec N., MV (16517); ♂, Merrijig, 30 Nov. 1971, MV (16564). **Victoria**: ♂, Bendigo, 10 Sep. 1922, Burns, Alec N., MV (16527); ♂, Heathmont, 23 Aug. 1930, Burns, Alec N., MV (16517); ♂, Merrijig, 30 Nov. 1971, MV (16564).

Diagnosis

Eyes hairy; metasomal bands narrow, silver. Male mid tibia with extensive areas of dark brown; fore basitarsus with distinct plume; S7 with narrow, rectangular lateral lobes. Female clypeus transversely convex, not flattened, with a straight basal margin; inner hind tibial spur with c. 9 teeth.

Variation

Both sexes sometimes have metasomal bands of moderate width and occasionally the bands are gold.

Descriptions

Male (holotype).—*Head* width 3.70 mm, body length 10.7 mm. Relative dimensions: HW 50, HL 39, UID 29,

UFW 30, LID 29, DMA 31, HVO 4, WOC 13, MOD 4, OOD 9, IAD 9, ASD 3, AOD 7, ML 19, BMW 7, MSL 1.8, SL 13, SW 3, FL c. 50.—*Eyes* hairy; face narrow, inner orbits parallel; length malar space c. 0.25× basal mandibular width; flagellum as long as head width; middle flagellomeres c. 1.5× as long as wide; hind tarsus as long as hind tibia; hind basitarsus 4.5× as long as wide; hind basitibial area carinate on posterior side only. Gonoforceps with long hair (Fig. 37); S7 with narrow, rectangular lateral lobes and strong posterior projections (Fig. 70).—*Scape*, labrum, mandible medially, tarsi, tibiae and distal ends of femora orange-brown, fore and mid tibiae medially suffused with dark brown; flagellum dark brown dorsally, mid brown ventrally. T1–5 with bands usually narrow, silver, sometimes of moderate width and occasionally gold.—*Clypeus*, excluding apex, densely punctate; scutum with dull sheen, pit-reticulate, close fine punctures.—*Face* densely and scutum closely covered with long, finely-branched, bright orange hair. Fore basitarsus with tapered plume of golden hair; femora and trochanters with much long pale hair.

Female (AM K.334760).—*Head* width 4.10 mm, body length 11.6 mm. Relative dimensions: HW 50, HL 37, UID 28, UFW 30, LID 30, DMA 31, HVO 5, WOC 13, MOD 4, OOD 8, IAD 8, ASD 3, AOD 9, ML 24, BMW 8, MSL 1.0, SL 15, SW 3, FL c. 33.—*Eyes* hairy; face slightly wider than long, inner orbits parallel; length malar space c. 0.2× basal mandibular width; clypeus transversely convex, basal suture horizontal, not bowed; flagellum shorter than head width, F1 1.6× as long as wide, F2–9 c. 1.2× as long as wide; inner hind tibial spur with c. 9 teeth; pygidial plate minutely emarginate, strongly elevated medially.—*Labrum* orange-brown; mandible medially amber; trochanters and femora dark brown; remainder of legs mid-brown. T1–4 with narrow silver, occasionally gold, bands.—*Clypeus* and supraclypeal area reticulate, densely punctate, scutum reticulate, weakly shining with close fine punctures.—*Head* with white to pale orange, plumose hair, dense in paraocular areas and on frons, open on clypeus and supraclypeal area. Scutum closely covered with very short, plumose, dull orange-brown hair; scopa brown; prepygidial fimbria brown.

Remarks. This species has commonly been misidentified in collections as *T. venustus* and the specimen used as the model for figs 198–200 in Michener (1965) was probably *T. orientalis* n.sp.

There are a number of sympatric species that are similar in appearance. Males may be distinguished from *T. venustus* by the extensive areas of dark brown on mid tibia and the shape of S7; from *T. aeratus* n.sp. by the presence of a plume on fore basitarsus; from *T. fuscus* n.sp. by paler colour and the shape of S7 and from *T. tenuiculus* by the shape of S7. Females may be distinguished from *T. venustus* by the narrow metasomal bands and straight basal margin of the clypeus; from *T. aeratus* n.sp. by unflattened clypeus; from *T. fuscus* n.sp. by the paler colour and number of teeth on inner hind tibial spur and from *T. tenuiculus* by the length of F1 and the number of teeth on inner hind tibial spur.

Distribution. Eastern Australia between Brisbane and Adelaide (BBS, CP, FLB, KAN, NET, NNC, NSS, SB, SCP, SEC, SEH, SEQ, VM) (Fig. 109).

Etymology. The specific name is a Latin adjective meaning eastern, referring to the distribution of this species.

Trichocolletes platyprosopis n.sp.

Figs 38, 71, 110

Type. Holotype ♂, 18 km NW Eneabba, Western Australia, 9–12 Sep. 1987, T. F. Houston, on flowers of *Daviesia*, in WAM 13908.

Specimens examined. The holotype and the following. **Western Australia**: 4♂, ♀, same data as holotype, WAM (13905–07,09,10); 3♂, 6♀, 28 km 26° W of N Eneabba, 28 Aug. 1999, T. F. Houston, on flowers of *Daviesia divaricata*, WAM (27508–12,14–17); ♀, 12 mls N Geraldton, 12 Jul. 1973, N. McFarland, WAA (45290); ♂, Nabawa, 9 Jul. 1998, S. R. Patterson, WAM (21394); ♀, Watheroo National Park (30.20°S 115.83°E), 3–5 Oct. 1980, T. F. Houston, on flowers of *Daviesia divaricata*, WAM (13838).

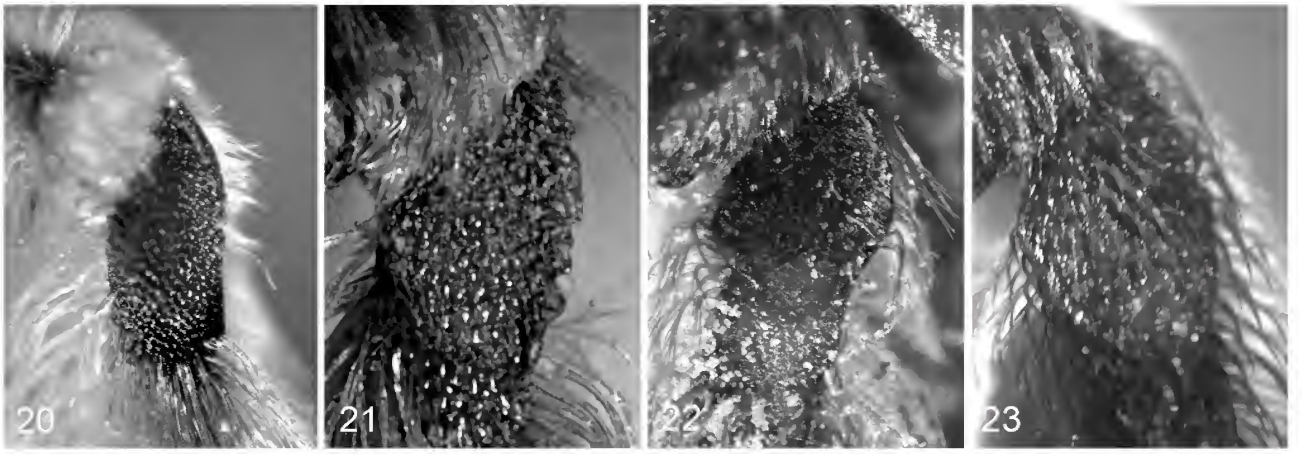
Diagnosis

Eyes not hairy; metasomal bands silver-white, ferruginous across anterior margin. Female clypeus polished and strongly flattened, almost spatulate; labrum tectiform. Male S7 distinctive (Fig. 71); legs slender, orange-brown; hind basitarsus gently bowed. Unlike any other species.

Descriptions

Male (holotype).—*Head* width 3.85 mm, body length 11.3 mm. Relative dimensions: HW 50, HL 38, UID 31, UFW 33, LID 30, DMA 29, HVO 0, WOC 14, MOD 4, OOD 8, IAD 7, ASD 3, AOD 8, ML 20, BMW 4, MSL 1.0, SL 13, SW 3, FL c. 54.—*Eyes* not hairy; face narrow; clypeus distinctly flattened though covered with dense pubescence; ocellar-ocular area strongly depressed; malar space short (length c. 0.2× basal mandibular width); flagellum longer than head width; all flagellomeres longer than wide. Legs very slender; hind tarsus 1.1× as long as hind tibia; hind basitarsus 5.7× as long as wide; gently bowed and tapering slightly towards distal end; basitibial area with pigmented posterior carina; fore tibial calcar with c. 5 short teeth. Gonoforceps transversely truncate with moderately short, stiff apical hairs (Fig. 38); S7 with small lateral lobes fused with posterior projections and basal teeth, approximately diamond-shaped (Fig. 71).—*Labrum* and mandible amber, scape, femora, tibiae and tarsi orange-brown, with darker suffusions on femora and hind tibia; coxae, trochanters and flagellum dorsally dark brown, ventrally mid-brown. T1–5 with moderately broad, white bands, distinctly ferruginous across anterior margin; T7 mid brown.—*Clypeus* densely punctate except ventral rim impunctate, polished; scutum strongly reticulate, obscuring punctures.—*Head* densely covered with long, orange hair, erect on clypeus. Scutum closely covered with long, densely-branched pale orange-brown hair; fore basitarsus without plume; hind femur with scattered white hair on anterior margin.

Female (WAM 27511).—*Head* width 4.20 mm, body length 12.8 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 31, LID 31, DMA 30, HVO 4, WOC 13, MOD 3, OOD 8, IAD 8, ASD 3, AOD 9, ML 21, BMW 5, MSL 0.5, SL 15, SW 3, FL c. 34.—*Eyes* not hairy; malar space short (length c. 0.1× basal mandibular width); labrum tectiform; clypeus strongly flattened, almost spatulate; supraclypeal area bulbous; middle flagellomeres c. 1.3× as long as wide; inner hind tibial spur with c. 8 long, well-spaced teeth; tarsal claws simple; pygidial plate broad, truncate, with medial elevation and wide, upturned margin.—*Labrum*, mandible medially, tarsi, tibiae and apical half femora orange-brown; coxae,



T. maximus *T. brachytomus* n.sp. *T. pulcherrimus* *T. dives*

Figs 20–23. Basal area of hind tibia of *Trichocolletes* females: (20) *T. maximus*, (21) *T. brachytomus* n.sp., (22) *T. pulcherrimus*, and (23) *T. dives*. Setae were removed from the *T. maximus* and *T. brachytomus* n.sp. specimens, but shortened by wear in the other cases.

trochanters and basal half of femora dark brown. T1–4 with moderately wide, white bands distinctly ferruginous across anterior margins; wings darkened.—*Surface of clypeus* polished with very broad irregular depressions, dulled basally with pit-reticulation; labrum with longitudinal medial carina and weak, oblique rugae laterally.—*Apico-lateral corners of clypeus*, paraocular areas and frons densely covered with golden-brown, plumose hair. Scutum closely covered with densely-branched, pale orange-brown hair tipped with dark brown; prepygidial fimbria chocolate brown; hind tibial scopa pale orange.

Remarks. This species is referred to as F265/M236 in Houston (2000).

Distribution. Geraldton Sandplains, Western Australia (GS) (Fig. 110).

Etymology. The specific name is from the Greek adjective for flat-faced, referring to the clypeus, particularly of the female.

Trichocolletes pulcherrimus Michener

Figs 9, 22, 26, 111

Trichocolletes (Callocolletes) pulcherrimus Michener, 1965, p. 265.

Specimens examined. Holotype ♂, Narrogin, Western Australia, 1 Nov. 1935, WAM (65–727) and the following. **Western Australia**: ♀, Dumbleyung, 14 Nov. 1966, H. Udell, WAM (9007); 4♀, 75 km E Hyden, 24–27 Oct. 1985, T. F. Houston, on flowers of *Gastrolobium spinosum*, WAM (8997–9000); 2♂, 61 km E Hyden, 14 Oct. 1979, T. F. Houston, on flowers of *Burtonia hendersoni*, WAM (9001–02); ♀, Regans Ford Moore River, 11 Nov. 1976, S. M. Postmus, on *Jacksonia* sp., WAM (9006); ♀, 10 S Perenjori, 1 Nov. 1958, E. F. Riek, ANIC; 3♀, 19 km ESE Southern Cross, 28 Oct. 1978, T. F. Houston, on flowers of *Gompholobium viscidulum*, WAM (9003–05).

Diagnosis

Length 16–18 mm; eyes not hairy; metasoma orange-brown with indistinct metasomal bands; flagellum banded dorsally in both sexes. Male hind tibia strongly expanded, without spurs; apical segment of flagellum truncate, slightly expanded on one side; fore trochanter with large spine. Female scape and more than half clypeus orange-brown.

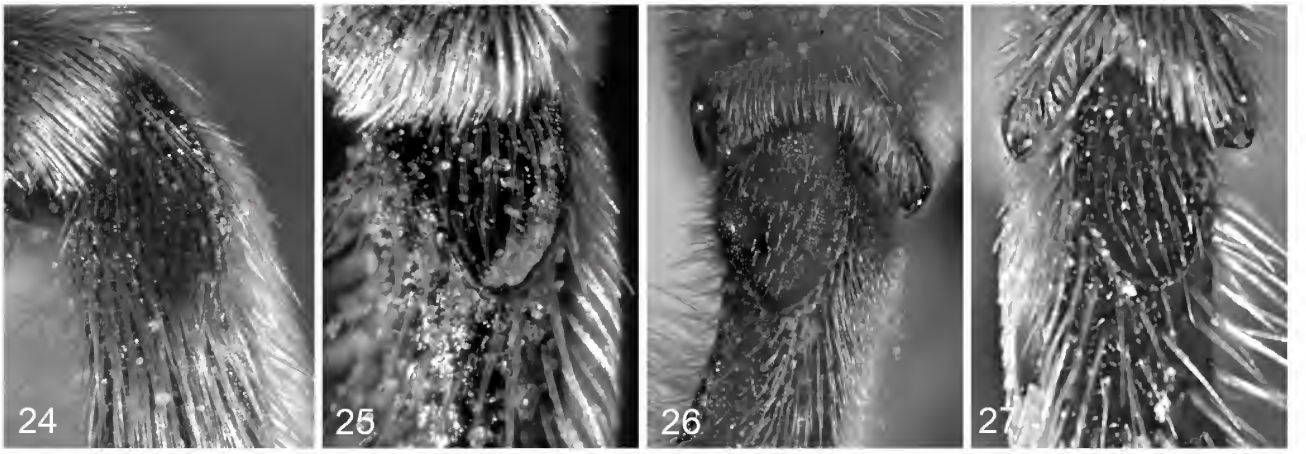
Remarks. Detailed descriptions can be found in Michener, 1965.

In 1965, Michener proposed division of the genus *Trichocolletes* into two subgenera, with this species as the sole member of the subgenus *Callocolletes*. At that time, the Colletidae family was regarded as a primitive lineage, but molecular evidence now indicates that it is one of the more derived (Danforth *et al*., 2006) and that separation of *Trichocolletes* from other Australian colletids occurred relatively early (Almeida and Danforth, 2009). However, the premise on which the subgenus was based remains unaltered. If the hind basitibial area of *T. pulcherrimus* females is intermediate in nature between those found in the remaining *Trichocolletes* species and those of other colletids, it might indicate that *T. pulcherrimus* occupies a basal position within the genus.

The use of molecular evidence from fresh material to test this hypothesis was, unfortunately, not possible as attempts to recollect specimens were unsuccessful, but the increased number of species now available made possible reassessment of the morphological evidence. Although the male exhibits a number of striking modifications including the absence of hind tibial spurs, Michener (1965, 2007) chose to give greater weight to the hind basitibial area and details of wing venation.

The basitibial area of females is difficult to observe because of a dense cover of stiff setae. When the setae are removed, the contiguous depressions at the base of each seta form a coarsely areolate surface (Fig. 22). Interpretation of the resulting structure can be difficult. Frequently specimens are found with the setae worn down to the tops of the depressions making the actual surface difficult to detect and producing an apparent rim to the basitibial area. A second difficulty is that even when setae are removed cleanly, the edge of the basitibial area may be coarsely serrated where it intersects the depressions (as shown for *T. brachytomus* n.sp. in Fig. 21). It is unclear whether or not this state should be classified as carinate.

A better character to use may be the hind basitibial area of males. Comparison of the basitibial areas of males of eight species with those of conspecific females confirmed that the degree of elevation of the basal area from the surrounding surface of the tibia in males reflected that observed for the females after removal of the setae. Of the



T. maximus *T. brachytomus* n.sp. *T. pulcherrimus* *T. lacaris* n.sp.

Figs 24–27. Basal area of hind tibia of *Trichocolletes* males: (24) *T. maximus*, (25) *T. brachytomus* n.sp., (26) *T. pulcherrimus*, and (27) *T. lacaris* n.sp.

38 species for which males are known, five, *T. brachytomus* n.sp., *T. dives, T. lacaris* n.sp., *T. pulcherrimus* and *T. tuberatus* n.sp., were found to have basitibial areas at least as well developed as in *T. pulcherrimus* (Fig. 26).

The second criterion used by Michener (1965) was the ratio of the lengths of the pterostigma and prestigma. This measurement is difficult to make accurately and involves a degree of subjectivity. It was found (Table 1, Fig. 28) that the ratio for *T. pulcherrimus* lies in the middle of the range for all species. Using 10 specimens each of *T. orientalis* n.sp. and *T. venustus*, it was estimated that the standard deviation of the measurements was 0.1.

Trichocolletes pulcherrimus males are unique in having a combination of unusual characters, but with the exception of the loss of the hind tibial spurs, similar characters occur separately or in other combinations in a number of species: projections are found on the fore trochanters of males of *T. avialis* n.sp. and *T. nitens* n.sp.; modified legs are found in *T. aureotinctus, T. avialis* n.sp., *T. burnsi, T. dives, T. dowerinensis, T. hackeri* and *T. macrognathus* n.sp.; and modified flagella occur in *T. dives* and *T. gelasinus* n.sp.. These male characters are not correlated with the female characters discussed above and it is concluded that the evidence presently available does not support recognition of the subgenus *Callocolletes*.

Distribution. Southwestern Australia (AW, MAL, SWA) (Fig. 111).

Table 1. Ratio of length stigma to length prestigma in forewing of females of some *Trichocolletes* species. Intraspecific variation was determined using 10 specimens each of *T. orientalis* n.sp. and *T. venustus*. The standard deviation of the measurements was 0.1.

species	length ratio stigma / prestigma	species	length ratio stigma / prestigma
T. aeratus n.sp.	1.50	*T. luteorufus* n.sp.	1.50
T. albigenae n.sp.	1.67	*T. macrognathus* n.sp.	1.64
T. aureotinctus	1.66	*T. marginatus*	1.69
T. brachytomus n.sp.	1.70	*T. maximus*	1.48
T. brunilabrum n.sp.	1.80	*T. micans* n.sp.	1.88
T. burnsi	1.85	*T. multipectinatus*	1.87
T. capillosus n.sp.	1.44	*T. nitens* n.sp.	1.73
T. centralis n.sp.	1.73	*T. orientalis* n.sp.	1.52
T. chrysostomus	1.66	*T. macrognathus* n.sp.	1.40
T. dives	1.73	*T. pulcherrimus*	1.60
T. dowerinensis	1.74	*T. rufibasis*	1.64
T. dundasensis n.sp.	1.50	*T. sericeus*	1.55
T. erythrurus	1.93	*T. serotinus* n.sp.	1.67
T. gelasinus n.sp.	1.54	*T. simus* n.sp.	1.60
T. grandis n.sp.	1.67	*T. soror* n.sp.	1.61
T. hackeri	2.00	*T. tenuiculus*	1.47
T. lacaris n.sp.	1.90	*T. tuberatus* n.sp.	1.93
T. latifrons	1.55	*T. venustus*	1.43
T. leucogenys n.sp.	1.71		

Trichocolletes rufibasis (Cockerell)

Figs 6, 39, 72, 112

Paracolletes rufibasis Cockerell, 1929a, p. 204 (male).
Trichocolletes (Trichocolletes) rufibasis.—Michener, 1965, p. 80.

Specimens examined. The holotype ♂, Eradu, Western Australia, Nicolson, AM (K.95635) and the following. **South Australia**: 8♀, Lake Gilles Natl Park (33.06°S 136.67°E), 13 Nov. 1975, T. F. Houston & J. A. Herridge, on *Daviesia nudula*, SAM (32-024523–30). **Western Australia**: 2♂, 22 km N Bullfinch, 7 Sep. 1979, T. F. Houston, on flowers of *Swainsona microphylla*, WAM (13990–91); 5♀, 22 km N Bullfinch, 2–3 Oct. 1981, T. F. Houston, on flowers of *Mirbelia depressa*, WAM (13992–96); ♂, ♀, Charles Darwin Reserve, Sep. 2009, R. Leys, AM (K.344826–27); ♂, 25 km S Cue, 31 Aug. 1981, G. A. Holloway, AM (K.344531); ♂, 18 km E Hyden (32.4170°S 119.0989°E), 10 Oct. 2009, M. Batley, AM (K.344825); 3♂, Kalamunda, WAM (13785–87); 4♀, Kalbarri, 29 Aug. 1970, K. T. Richards, WAA (80836,38,46,47); 7♂, 2♀, McDermid Rock, 27 Sep.–3 Oct. 1978, T. F. Houston et al., on flowers of *Daviesia costata*, WAM (13971–7,13997,19121); ♂, Mt Jackson, 5–11 Sep. 1979, T. F. Houston, on flowers of *Dryandra arborea*, WAM (13998); ♂, 14 km NW Narrogin (32.8761°S 117.0425°E), 9 Oct. 2009, M. Batley, AM (K.344824); ♂, 4♀, National Park, WAM (13769–72); 3♂, 2♀, Neerabup Nat. Park 15 km NW Wanneroo, 16 Oct. 1994, T. F. Houston *et al.*, on flowers of *Daviesia*, WAM (13595–99); 8♀, Lake Gilles Natl Park (33.06°S 136.67°E), 13 Nov. 1975, T. F. Houston & J. A. Herridge, on *Daviesia nudula*, SAM (32-024523–30); ♂, 16 km S Norseman (32.3403°S 121.7575°E), 7 Oct. 2009, M. Batley, AM (K.344823); 30♂,7♀, 7 km SSW Norseman, 19 Sep. 1981, I. D. Naumann & J. C. Cardale, ANIC; ♂, Tallering Stn, 1 Sep. 1976, R. P. McMillan, WAM (13788).

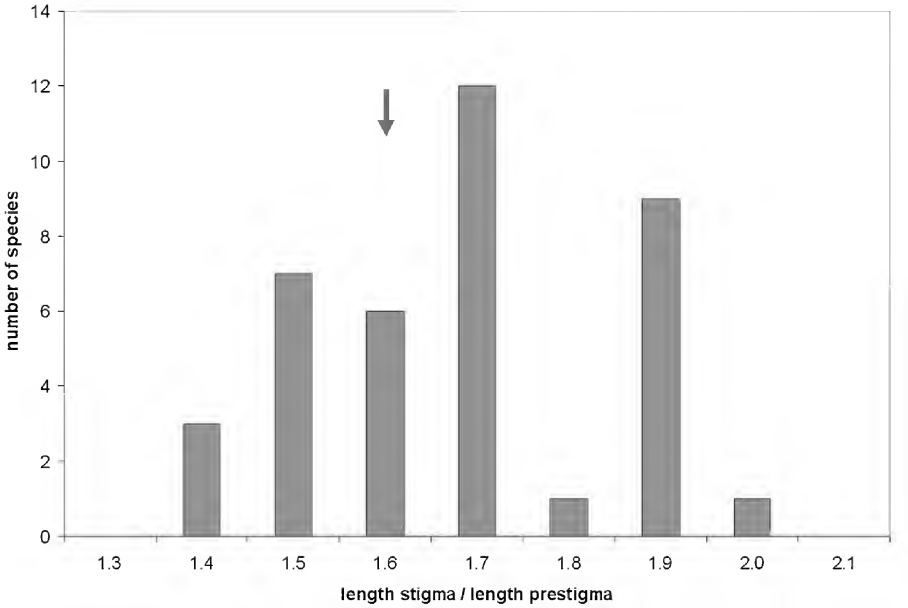


Fig. 28. Number of species versus ratio of length stigma to length prestigma in forewing of *Trichocolletes* females. The ratio for *T. pucherrimus* is indicated by the arrow.

Diagnosis

Eyes not hairy; metasomal bands gold; metasoma usually with large areas of orange-brown on T1,2; malar space very short. Male metasoma noticeably slender; S7 with sinuate posterior margin (Fig. 72). Female clypeus usually flattened sagittaly.

Variation

The species is rather variable in colour. A long series of specimens collected near Norseman contained examples with and without orange-brown on the metasoma while all eight specimens collected at Kalamunda National Park were without orange-brown and had silver metasomal bands. The body lengths of the latter specimens were on average 1 mm greater than for the former. Females from Bullfinch and Lake Gilles had red-brown rather than orange-brown markings and the clypeus was not flattened. When associated males are available, the last two may warrant classification as a separate species or subspecies. Variation in the shape of the posterior margin of S7 of males was also observed between specimens having of the typical colour form.

Descriptions

Male (holotype).—*Head* width 3.65 mm, body length 11.6 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 31, LID 28, DMA 26, HVO 5, WOC 13, MOD 4, OOD 9, IAD 9, ASD 3, AOD 8, ML 19, BMW 7, MSL 0.5, SL 14, SW 3, FL c. 51.—*Eyes* not hairy; head broad, inner orbits converging ventrally; malar area short (length c. 0.1× basal mandibular width); flagellum as long as head width; middle flagellomeres c. 1.6× as long as wide. Legs slender; hind tarsus 1.2× as long as hind tibia; length basitarsus 4.8× width. Genital capsule like that for *T. orientalis* n.sp., but penis valves slightly shorter and broader (Fig. 39); S7 (WAM 13971) lateral lobes triangular with strongly rounded corners and sinuate posterior margin, basal teeth obsolete (Fig. 72).—*Labrum*, scape, large part of clypeus ventrally, mandible, anterior and posterior regions of T1, anterior half T2, anterior quarter of T3, distal ends of femora and all of tibiae and tarsi orange-brown; coxae, trochanters and most of femora dark brown; flagellum mid to dark brown, F2–8 paler ventrally. T1–5 with gold bands; T7 red-brown medially.—*Scutum* dull with strong pit-reticulation almost obscuring punctures.—*Face* densely covered with long, erect, bright orange hair; scutum with thin cover of long, dull orange, finely-branched hair; fore basitarsus without plume; other legs with sparse hair.

Female (WAM 13975), not previously described.—*Head* width 3.85 mm, body length 11.5 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 32, LID 30, DMA 28, HVO 5, WOC 14, MOD 4, OOD 8, IAD 8, ASD 3, AOD 9, ML 19, BMW 7, MSL 0.5, SL 15, SW 3, FL c. 33.—*Eyes* not hairy; head broad, orbits slightly convergent ventrally; clypeus sagittaly flattened; supraclypeal area prominent; malar space short (length c. 0.1× basal mandibular width); middle flagellomeres slightly longer than wide; inner hind tibial spur with c. 9 teeth; tarsal claws with large, triangular inner ramus; pygidial plate entire or with minute apical emargination and broad, low medial elevation.—*Labrum*, ventral rim of clypeus, most of mandible, anterior half of T1,2 orange-brown; posterior half T1,2 and legs dark brown; S2 yellow-brown; remaining sterna brown. T1–4 with pale gold bands.—*Clypeus* reticulate with close to dense, large punctures, supraclypeal area densely punctate; scutum with strong pit-reticulation obscuring punctures.—*Paraocular areas* and frons covered with long, plumose, orange hair, paler ventrally and tipped with dark brown near ocelli. Scutum openly covered with short, plumose, orange-brown hair with dark tips; hind tibial scopa brown to dark brown, with a little white along anterior margin; prepygidial fimbria dark brown.

Remarks. The holotype is smaller than average, with most males slightly over 12 mm in length. This species closely resembles *T. soror* (see below).

This species is referred to as F271/M237, F255/M229 and F263/M234 in Houston (2000).

Distribution. Southwestern Australia (AW, COO, GAW, GS, JF, MAL, MUR, SWA, YAL) (Fig. 112).

Trichocolletes sericeus (Smith)

Figs 5, 40, 42, 73, 113

Anthoglossa sericea Smith, 1862, p. 59 (female).
Trichocolletes (Trichocolletes) sericeus.—Michener, 1965, p. 80.
Trichocolletes (Trichocolletes) marginatulus Michener, 1965, p. 246. **n. syn.**

Specimens examined. The holotypes of *T. sericeus* ♀, Australia, BMNH Hym 17.a.395 and *T. marginatulus* ♂, Dunwich, Stradbroke Island, Queensland, 21 Aug. 1958, C. D. Michener, ANIC and the following. **New South Wales**: ♀, Kandos Weir, 10 Nov. 1981, N. W. Rodd, AM (K.344532); 3♂, 2♀, Mellong Swamp (33.0858°S 150.7058°E), 29 Sep.–3 Nov. 2000, M. Batley, *ex Dillwynia floribunda, Podolobium ilicifolium, Daviesia alata & Daviesia acicularis*, AM (K.224180–81; K.316504–06); ♀, Mellong Swamp, 6 Oct. 2001, M. Batley, *ex Podolobium ilicifolium*, AM (K.316507); 4♂, Mellong Swamp (33.0858°S 150.7058°E), 25 Sep. 2009, M. Batley, AM; 10♂, 5♀, Mellong Swamp, 12–21 Oct. 2001, J. Indsto, AM. **Queensland**: ♂, ♀, Dunwich, Stradbroke Is, 21–22 Oct. 1958, C. D. Michener, UQIC; ♂, ♀, Dunwich, Stradbroke Island, 21 Aug. 1958, C. D. Michener, ANIC. **South Australia**: ♀, 12 km S Monarto South Ferries Nat Pk, 8 Oct. 1973, P. B. McQuillan, on *Leptospermum* bloom, SAM (32-024667); ♂, Pinnaroo (35.5539°S 140.7614°E), 7 Oct. 2003, M. Batley, *ex Dillwynia* sp., AM (K.316508). **Victoria**: ♂, ♀, Hattah, 11 Oct. 1953, P.J., MV (16505, 48).

Diagnosis

Eyes not hairy; metasomal bands broad; prominent supraclypeal area inclined relative to clypeus. Male scapes swollen (Fig. 5); supraclypeal area with dense hair. Female clypeus with coarse, dense punctures.

Remarks. Michener (1965) gave detailed descriptions of this species as *T. marginatulus*. Similar to *T. chrysostomus* from which it is distinguished by slightly smaller size (length male c. 11 mm, female c. 11.5 mm), the presence of hair on supraclypeal area of male and the density of punctures on the clypeus of female. Male genitalia and hidden sterna (Figs 40, 42, 73) are almost identical to those of *T. chrysostomus.*

Distribution. Southeastern Australia between Brisbane and Adelaide (MDD, SB, SEQ) (Fig. 113).

Trichocolletes serotinus n.sp.

Figs 43, 74, 114

Type. Holotype ♂, Mount Hay Road (33.6389°S 150.3983°E), 17 Oct. 1998, M. Batley, *ex Dillwynia floribunda*, in AM K.344806.

Specimens examined. The holotype and the following. **Australian Capital Territory**: ♂, Hill W side Condor Ck bridge, 6 Nov. 1993, G. J. Davis & G. V. Maynard, *Daviesia mimosoides*, MV (930642). **New South Wales**: ♀, Adaminaby-Kiandra Road (35.9011°S 148.5794°E), 31 Dec. 2008, M. Batley, *ex Mirbelia platylobioides*, AM (K.344813); 2♂, Blue Mountains, 3–4 Oct. 1915, A. Musgrave, ANIC; 12♂, Blue Mtns, 3 Oct. 1915, A. Musgrave, AM (K.344534–45); 6♂, 2♀, Clarence, 28–31 Oct. 1979, N. W. Rodd, AM (K.344550–57); ♀, 9 km E Kiandra (35.9125°S 148.5794°E), 31 Dec. 2008, M. Batley, AM (K.224900); ♂,2♀, 12 km SE Kiandra (35.9356°S 148.5928°E), 31 Dec. 2008, M. Batley, *ex Mirbelia platylobioides*, AM (K.224904–06); ♂, ♀, Mt Canobolas (33.3181°S 148.9817°E), 9 Nov. 2005, M. Batley, *ex Mirbelia oxyloboides*, AM (K.344814–15); ♂, Mt Kaputar NP, 2 Oct. 1976, E. M. Exley & T. Low, UQIC; 2♂, ♀, Mt Kaputar NP, 12 Nov. 1979, N. W. Rodd, AM (K.344558–60); ♀, Mount Wilson (33.5417°S 150.3414°E), 25 Oct. 2002, M. Batley, *ex Boronia microphylla*, AM (K.344811); 3♀, Mount Wilson (33.5400°S 150.3442°E), 12 Nov. 1999, M. Batley, *ex Daviesia alata*, AM (K.344807–09); ♀, Napoleon Reef (33.4167°S 149.7497°E), 7 Nov. 2005, M. Batley, *ex Pultenaea setulosa*, AM (K.344812); 2♂, 2♀, Nullo Mtn, 21 Nov. 1978, N. W. Rodd, AM (K.344546–49); 3♂, Wentworth Falls, 27 Oct. 1930, Burns, Alec N., MV (16561–63). **South Australia**: 4♂, ♀, Kyeema Nat Pk nr Meadows, 9 Oct. 1972, T. F. Houston, on *Daviesia corymbosa*, SAM (32-024657–61); ♂, ♀, Mt Lofty summ, 26 Oct. 1964, T.F.H., on *Platylobium*, SAM (32-024453–54); ♂, Mt Lofty summit, 4 Oct. 1963, *ex Daviesia*, SAM (32-024450); ♀, Rocky River, Kangaroo Is, 31 Oct. 1964, S. Barker, SAM (32-024452); ♂, Rocky River, Kangaroo Is, 4 Oct. 1970, T. F. Houston, on *Leucopogon*, SAM (32-024662); ♂, Waitpinga, 3 Oct. 1965, T. F. Houston, on *Daviesia*, SAM (32-024451). **Tasmania**: ♀, Bridport, 28 Oct. 1913, F. M. Littler, AM (K.44076); 11♂, 4♀, Bridport, 26-30 Oct. 1913, F. M. Littler, SAM (32-024433–47); ♀, Hobart, 24 Oct. 1917, G. H. Hardy, AM (K.95636); 3♂, Hobart, 22 Oct. 1916, G. H. Hardy, QM; ♂, Hugel River (42.1000°S 146.1500°E), 6 Dec. 1974, Neboiss, Arturs, MV (16497). **Victoria**: ♂, ♀, Bright, H. W. Davey, QM; ♂, Buckland River, 30 Nov. 1964, MV (16503); ♂, Caulfield, MV (16560); 7♂, ♀, Dartmouth Dam, 31 Oct. 1976, Calder, Andrew A., MV (16565); ♂, Dromana, 3 Nov. 1931, F. E. Wilson, MV (16498); ♀, 2 km S Falls Creek (36.8756°S 147.2861°E), 2 Jan. 2009, M. Batley, *ex Mirbelia platylobioides*, AM (K.224931); ♂, Ferntree Gully, 28 Sep. 1930, Burns, Alec N., MV (16525); ♂, Frankston, 18 Oct. 1932, Burns, Alec N., MV (16545); ♂, Grampians, 1 Oct. 1928, F. E. Wilson, ANIC; 3♂, Grampians, Oct. 1928, Wilson, F E., MV (16489,90,99); 2♂, 3♀, Grampians, 10 Nov. 1930 & 23 Oct. 1932, Burns, Alec N., MV (16515,19,16543–44); 2♂, ♀, Halls Gap, 1 Nov. 1928, CB, SAM (32-024448–49); ♂, Melbourne, R. E. Turner, BM; 2♂, ♀, 15 km E Mount Hotham (37.0283°S 147.2717°E), 3 Jan. 2009, M. Batley, *ex Mirbelia platylobioides*, AM (K.224948–49,56); ♂, Mt Buffalo, 18 Dec. 1933, A. Musgrave, AM (K.95638); ♂, Mount Buffalo, 13 Jan. 1955, Neboiss, Arturs, ANIC; 2♂, Mount Buffalo, 13 Jan. 1955, Neboiss, Arturs, MV (16487–88); ♂, Upwey, 22 Feb. 1930, Wilson, F E., MV (16522).

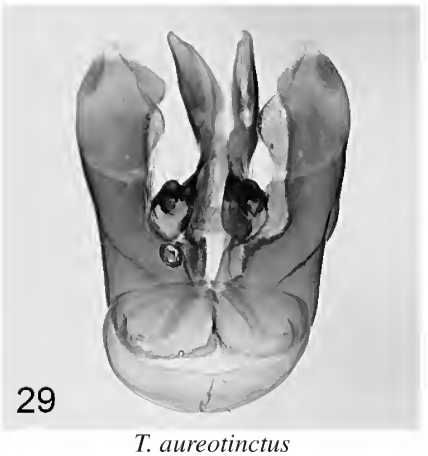
Diagnosis

Eyes not hairy; metasomal bands gold; scutal hair dull orange-brown. Active in late spring and summer in Eastern Australia.

Descriptions

Male (holotype).—*Head* width 3.65 mm, body length 11.3 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 30, LID 27, DMA 28, HVO 4, WOC 15, MOD 5, OOD 8, IAD 10, ASD 4, AOD 7, ML 20, BMW 7, MSL 0.5, SL 14, SW 3, FL c. 53.—*Eyes* not hairy; face almost quadrate, inner orbits converge ventrally; length malar space c. 0.1× basal mandibular width; flagellum as long as head width; middle flagellomeres c. 1.3× as long as wide. Legs slender; hind tarsus 1.1× as long as hind tibia; hind basitarsus 5.15× as long as wide; basitibial area indistinct. Gonoforceps broadened apically, hairs relatively sparse; S7 lateral lobes obliquely triangular with posterior margin rounded, posterior projections obsolete (Fig. 74).—*Labrum*, tarsi,

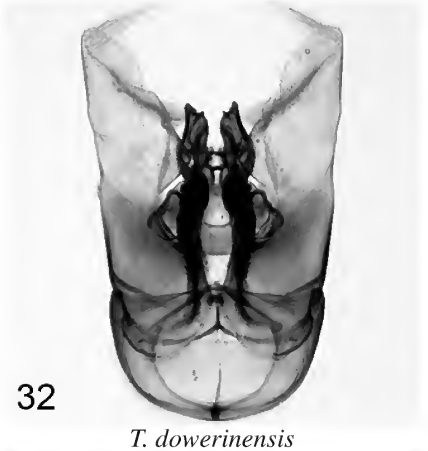
Figs 29–40 (facing page). Genital capsule of male *Trichocolletes*, dorsal view: (29) *T. aureotinctus*, (30) *T. burnsi*, (31) *T. dives*, (32) *T. dowerinensis*, (33) *T. gelasinus* n.sp., (34) *T. latifrons*, (35) *T. macrognathus* n.sp., (36) *T. marginatus*, (37) *T. orientalis* n.sp., (38) *T. platyprosopis*, (39) *T. rufibasis*, and (40) *T. sericeus*.



T. aureotinctus

T. burnsi

T. dives

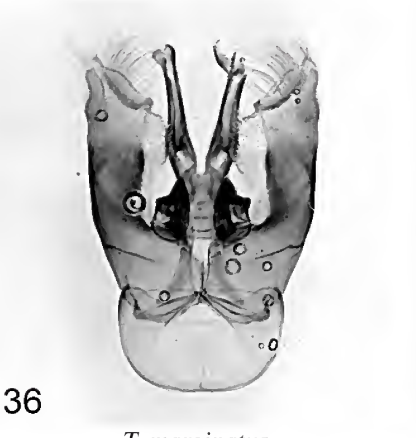


T. dowerinensis

T. gelasinus n.sp.

T. latifrons

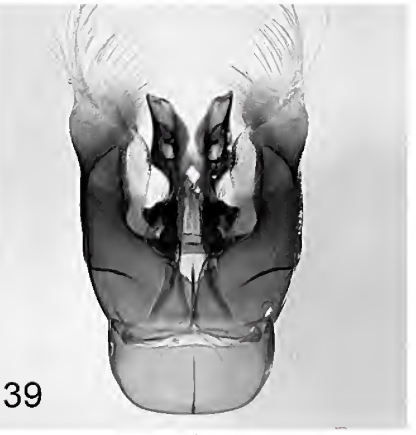
T. macrognathus n.sp.



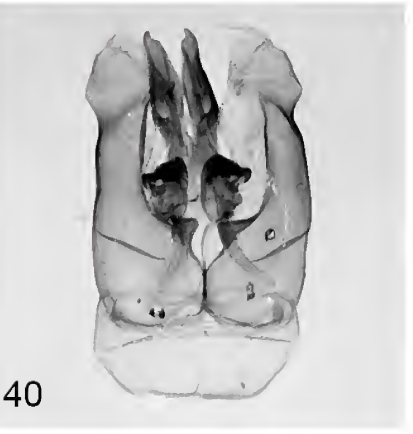
T. marginatus

T. orientalis n.sp.

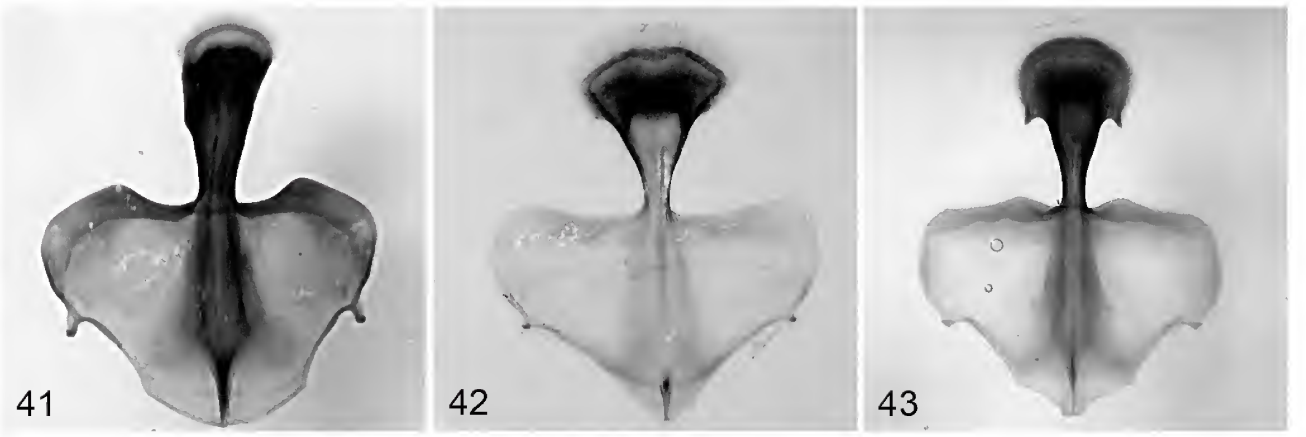
T. platyprosopis



T. rufibasis



T. sericeus



T. dowerinensis *T. sericeus* *T. serotinus* n.sp.

Figs 41–43. Eighth sternum of *Trichocolletes* males, ventral view: (41) *T. dowerinensis*, (42) *T. sericeus*, and (43) *T. serotinus* n.sp.

distal ends of femora, fore and mid tibiae and scape orange-brown; scape often with dark suffusions, occasionally black; fore and mid tibiae with dark suffusions medially; mandible amber medially; flagellum (other than F1) brown ventrally. T1–5 with moderate width gold bands.—*Clypeus* densely punctate basally, apical 20% impunctate, basal suture indistinct; scutum dull with strong pit-reticulation obscuring close punctures.—*Face* densely covered with long, plumose, orange hair. Scutum closely covered with plumose dull orange hair; fore basitarsus with weak fringe of pale hair; anterior margin of hind tibia with close fringe of erect pale hair.

Female (AM K.334811).—*Head* width 4.00 mm, body length 11.5 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 33, LID 30, DMA 31, HVO 3, WOC 7, MOD 4, OOD 8, IAD 8, ASD 3, AOD 9, ML 22, BMW 9, MSL 0.8, SL 16, SW 3, FL c. 29.—*Eyes* not hairy; face wider than long, inner orbits slightly convergent ventrally; malar space short (length c. 0.1× basal mandibular width); clypeus transversely convex, basal suture straight; flagellum short; middle flagellomeres c. 1.1× as long as wide; inner hind tibial spur with c. 11 long teeth; tarsal claws with short basal ramus; pygidial plate entire with distinct medial elevation.—*Labrum* and mandible deep amber; flagellum brown ventrally; legs dark brown. T1–4 with gold bands of moderate width.—*Clypeus* polished, weakly reticulate basally, with close, large punctures, supraclypeal area impunctate medially; scutum dull with moderately strong pit-reticulation and close to dense small punctures.—*Face* with long, plumose hair, white, sparse to open on clypeus, white, dense in paraocular areas and close, dull orange-brown on frons. Scutum closely covered with short, plumose dark-tipped orange-brown hair; hind tibial scopa white, becoming brown towards posterior margin; pre-pygidial fimbria pale brown.

Remarks. See remarks about misidentification of *T. marginatus*.

Distribution. Cooler regions of southeastern Australia including Tasmania (AA, FLB, FLI, KAN, NAN, SB, SCP, SEC, SEH, TSR,VM) (Fig. 114).

Etymology. The specific name is a Latin adjective meaning late in coming, referring to the flight phenology.

Trichocolletes simus n.sp.

Figs 75, 115

Type. Holotype ♂, Eneabba, Western Australia, 18 May 1979, R. P. McMillan, on *Daviesia*, in WAM 13982.

Specimens examined. The holotype and the following. **Western Australia**: ♀, same data as holotype WAM (13981); ♂, 10♀, Cockleshell Gully (30.09°S 115.06°E), 28 May 1987, M. Lyons, on flowers of *Daviesia*, WAM (13624–33, 13983).

Diagnosis

Length 11–12 mm; eyes not hairy; clypeus strongly deflexed and weakly protuberant; palpi very short; metasomal bands silver-white; scutal hair orange. Male T1,2 with large orange-brown areas.

Descriptions

Male (holotype).—*Head* width 3.80 mm, body length 11.3 mm. Relative dimensions: HW 50, HL 36, UID 29, UFW 30, LID 28, DMA 28, HVO 6, WOC 15, MOD 4, OOD 7, IAD 7, ASD 4, AOD 7, ML 16, BMW 7, MSL 0.5, SL 12, SW 3, FL c. 48.—*Eyes* large, not hairy; face narrow, inner orbits converge ventrally; clypeus transversely convex, strongly deflexed near base so that lower margin protrudes only slightly; malar space short (length c. 0.1× basal width mandible); palpi short, labial palpus < ½ as long as post palpal part of galea; ocelloccular area strongly depressed; flagellum moderately short, middle flagellomeres c. 1.5× as long as wide; fore basitarsus short; hind legs very long, slender; tarsus as long as hind tibia; hind basitarsus 5.4× as long as wide; posterior margin basitibial area with strong, pigmented carina reaching apex. Genital capsule like that for *T. macrognathus* n.sp. (Fig. 35); S7 lateral lobes rounded, posterior projections and basal teeth obsolete (Fig. 75).—*Labrum*, mandible, scape and most of flagellum ventrally, most of T1,2 and 7, tarsi, mid and hind femora and tibiae, inner surface fore tibia orange-brown; remaining areas of legs, flagellum dorsally, small medial suffusions on T1,2 and large lateral spots on T2 dark brown. T1–5 with silver bands, ferruginous across anterior margin.—*Scutum* dull, strongly reticulate.—*Face* below ocelli densely covered with long, erect, bright orange hair.

Scutum openly covered with long, finely-branched, orange hair; fore trochanter and femur with long, orange hair; fore basitarsus with long golden hair; hind femur with weak hair tuft at distal end. Semi-adpressed hair on T3–6 somewhat paler than underlying integument.

Female (WAM 13981).—*Head* width 3.55 mm, body length 11.5 mm. Relative dimensions: HW 50, HL 42, UID 30, UFW 32, LID 30, DMA 29, HVO 5, WOC 14, MOD 4, OOD 8, IAD 9, ASD 3, AOD 9, ML 20, BMW 7, MSL 0.5, SL 14, SW 3, FL c. 36.—*Eyes* not hairy; face approximately quadrate, inner orbits slightly convergent ventrally; clypeus, malar space and palpi as for male; middle flagellomeres c. 1.1× as long as wide; inner hind tibial spur with c. 8 long slender teeth; tarsal claws with minute inner rami; pygidial plate large, truncate, with broad medial elevation and narrow margin.—*Labrum* and mandible orange-brown; flagellum dorsally dark brown, paler ventrally; legs dark brown; pygidial plate red-brown. T1–4 with moderate width white bands, ferruginous across anterior margin.—*Clypeus* polished with weak reticulation, closely covered with large punctures; supraclypeal area densely punctate.—*Face* with long, plumose, pale orange hair, sparse on clypeus and supraclypeal area, dense in paraocular areas and on frons. Scutum closely covered with plumose, dark-tipped orange hair; prepygidial fimbria very pale to mid brown.

Remarks. Association of the sexes is based morphological similarities, including length of palpi and shape of clypeus and on two coincident collection events. This species is referred to as F251 (part), F264/M235 in Houston (2000).

Distribution. Geraldton Sandplains, Western Australia (GS) (Fig. 115).

Etymology. The specific name is a Latin adjective meaning sub-nosed, referring to the shape of the clypeus.

Trichocolletes soror n.sp.

Figs 76, 116

Type. Holotype ♂, East Yuna Reserve 34 km WNW Mullewa, Western Australia, 13–16 Sep. 1984, T. F. Houston, on yellow and red pea flowers, in WAM 14002.

Specimens examined. The holotype and the following. **Western Australia**: 2♀, same data as holtype, WAM (14003–04); ♀, East Yuna Reserve 34 km WNW Mullewa, 23–24 Sep. 1983, C. & T. Houston, on flowers of *Dampiera* near pea flowers, WAM (13999); ♀, East Yuna Reserve 34 km WNW Mullewa, 28–29 Aug. 1984, T. F. Houston & B. P. Hanich, on flowers of *Comesperma*, WAM (14000); ♀, East Yuna Reserve 34 km WNW Mullewa, 24–28 Aug. 1985, T. F. Houston, on flowers of *Comesperma scoparium*, WAM (14001); ♀, 9 km 13° N of W from Eurardy HS (27.6722°S 114.7167°E), 25 Aug. 1999, T. F. Houston, on flowers of *Mirbelia spinosa*, WAM (27493); ♀, 13 km 35°S of W Eurardy HS (27.7611°S 114.5694°E), 25–26 Aug. 1999, T. F. Houston, on flowers of *Jacksonia velutina*, WAM (27494); 3♂, 10 km S Nerren Nerren HS, 19 Aug. 1980, C.A.Howard & T. F. Houston, on flowers of *Chorizema ericifolium*, WAM (14005–07); ♀, 14 km S Nerren Nerren HS, 28 Aug. 1984, T. F. Houston & B. P. Hanich, on yellow pea flowers, WAM (14008); ♀, 8 km NE Tamala HS (c. 27°S 114°E), 21–23 Aug. 1980, C. A. Howard & T. F. Houston, on flowers of *Mirbelia ramulosa*, WAM (14009).

Diagnosis

Eyes not hairy; metasoma partly or wholly orange or red-brown; metasomal bands gold. Male metasoma slender; T1,2 usually with large areas of orange-brown; posterior margin of S7 not sinuate (Fig. 76). Female robust; metasoma red-brown with broad tergal bands, occasionally indistinct; pygidial plate with deep emargination; clypeus uniformly convex.

Descriptions

Male (holotype).—*Head* width 3.80 mm, body length 13.6 mm. Relative dimensions: HW 50, HL 40, UID 32, UFW 32, LID 30, DMA 29, HVO 3, WOC 15, MOD 4, OOD 9, IAD 10, ASD 3, AOD 8, ML 18, BMW 6, MSL 0.5, SL 13, SW 3, FL c. 53.—*Eyes* not hairy; face wider than long, inner orbits slightly convergent ventrally; malar space short (length c. 0.1× basal mandibular width); length of flagellum greater than head width; middle flagellomeres c. 1.5× as long as wide. Legs slender; mid tibia slightly incrassate; hind tarsus 1.2× as long as hind tibia; length basitarsus 3.6× width; basitibial area short, posterior margin with angular edge but no carina. Genital capsule like that for *T. rufibasis* (Fig. 39); S7 lateral lobes triangular with strongly rounded corners and smooth posterior margin, basal teeth obsolete (Fig. 76).—*Head* and mesosoma predominantly black; labrum and ventral half clypeus cream; mandible, scape, flagellum ventrally, tarsi, fore tibia, both ends mid and hind tibiae and distal ends of femora orange-brown; flagellum dorsally dark brown. T1 orange-brown with broad, transverse dark brown band; T2 orange-brown with narrow, transverse brown band ending in large patches laterally; lateral margin with large black oval mark. T1–5 with wide, gold bands; T7 dull orange-brown; S2,3 mostly yellow-brown; remaining sterna dark brown with yellow-brown areas basally.—*Scutum* dull with strong pit-reticulation obscuring punctures.—*Face* densely covered with strongly branched, orange hair, erect on clypeus. Scutum and scutellum openly covered with long plumose dull orange hair; fore basitarsus without plume.

Female (WAM 14003).—Head width 3.95 mm, body length 12.6 mm. Relative dimensions: HW 50, HL 39, UID 30, UFW 32, LID 31, DMA 30, HVO 4, WOC 14, MOD 4, OOD 8, IAD 8, ASD 3, AOD 9, ML 20, BMW 7, MSL 0.5, SL 15, SW 3, FL c. 27.—*Eyes* not hairy; face wider than long, inner orbits almost parallel; malar space short (length c. 0.1× basal mandibular width); clypeus transversely convex; middle flagellomeres c. 0.85× as long as wide; inner hind tibial spur with c. 8 long teeth; tarsal claws with large, triangular inner ramus; pygidial plate with deep, narrow emargination.—*Head* and mesosoma predominantly black; mandible, labrum, tarsal segments 4 and 5 and extreme ventral margin of clypeus orange-brown; ventral half of clypeus and remainder of legs dark brown; metasomal terga red-brown with varible dark suffusions; T2 with large black oval marks laterally. T1–4 with broad, gold bands, sometimes indistinct.—*Clypeus* polished, weakly reticulate basally, with dense, large punctures; supraclypeal area densely covered with smaller punctures; scutal sculpture as for male.—*Paraocular areas* and frons with long, dense, plumose, orange hair; clypeus, supraclypeal area and gena with sparse, long, orange hair. Scutum and scutellum openly covered with moderately short, plumose, dull orange hair; hind tibial scopa honey-brown; T1 laterally with sparse, long, pale hair; prepygidial fimbria pale brown.

Remarks. There are many similarities between this species and *T. rufibasis*. Males may be distinguished from *T. rufibasis* by the stiffer hair clypeal hair, darker legs, colour of first flagellomere (paler ventrally than in *T. rufibasis*) and non-sinuate posterior margin of S7. Females may be distinguished from *T. rufibasis* by the deep emargination of the pygidial plate, the uniformly convex clypeus and the red, rather than orange, colour on areas of the metasoma.

This species is referred to as F262/M233 (part) in Houston (2000).

Distribution. Coastal Western Australia near Geraldton (GS, YAL) (Fig. 116).

Etymology. The specific name is a Latin noun meaning sister, referring to the similarity between this species and *T. rufibasis*.

Trichocolletes tenuiculus Rayment

Figs 77, 117

Trichocolletes tenuiculus Rayment, 1931, p. 162.
Trichocolletes (Trichocolletes) tenuiculus.—Michener, 1965, p. 80.

Specimens examined. The holotype ♂, Canowindra, New South Wales, Aug. 1930, M. Dwyer, ANIC and the following. **Australian Capital Territory**: ♂, 1.9 km S Condor Ck Bridge Rd, Brindabella Ra., 27 Sep. 1993, G. J. Davis & G. V. Maynard, off *Daviesia and Hardenbergia violacea*, MV; ♂, 2♀, Pierces Creek Forrest, 26 Sep. 1993, G. J. Davis & G. V. Maynard, off *Hardenbergia violacea*, MV; ♂, Uriara Crossing Rd Uriara Forest, 12 Aug. 1994, G. J. Davis & G. V. Maynard, MV (940553); 10♂, Vanitys Crossing Rd Uriara Forest, 25 Aug. 1994, G. J. Davis, *Hardenbergia*, MV (940545–52,54,55). **New South Wales**: ♂, 3♀, Doyles Creek (32.5219°S 150.7972°E), 19–22 Aug. 2005, M. Batley, AM (K.316543–46); 3♂, 3♀, Mount Canobolas (33.33°S 148.98°E), 24–25 Sep. 2005, M. Batley, AM (K.316552–57); 4♂, ♀, Mount Canobolas (33.3320°S 148.9850°E), 4–9 Sep. 2002, M. Batley, AM (K.316536–39,42); ♀, Mount Canobolas (33.3497°S 149.0164°E), 28 Sep. 2005, M. Batley, AM (K.316559); ♂, Mullion Flora Res. (33.11°S 149.17°E), 27 Sep. 2005, M. Batley, AM (K.316558); 2♀, Paling Yards (33.3570°S 148.9129°E), 7 Sep. 2002, M. Batley, AM (K.316540–41); ♀, Penrose State Forest (34.6589°S 150.2305°E), 4 Sep. 1999, M. Batley, AM (K.316533); ♀, Tallong (34.7194°S 150.5639°E), 30 Sep. 2000, M. Batley, AM (K.316535); ♂, 4♀, Wollar (32.3608°S 149.9214°E), 10 Sep. 2005, M. Batley, AM (K.316547–51); ♂, ♀, Mullion Range (33.1703°S 149.1828°E), 5 Sep. 2009, M. Batley, AM (K.316614); ♀, Willow Tree, 1 Sep. 1953, ANIC.

Diagnosis

Length c. 13 mm; eyes hairy; metasomal bands narrow, silver with brown anterior margins. Male fore basitarsus with a weak fringe rather than plume, S7 lateral lobes broadly triangular with truncated ends; scapes frequently with dark suffusions. Female flagellum with relatively long F1; frontal carina frequently ends in a small tubercle on the supraclypeal area.

Descriptions

Male (AM K.316557).—*Head* width 4.25 mm, body length 12.8 mm. Relative dimensions: HW 50, HL 41, UID 29, UFW 29, LID 29, DMA 29, HVO 4, WOC 13, MOD 4, OOD 8, IAD 9, ASD 4, AOD 6, ML 19, BMW 7, MSL 2.0, SL 13, SW 3, FL c. 53.—*Face* narrow; length malar space c. 0.25× basal mandibular width; flagellum slightly longer than head width; middle flagellomeres c. 1.6× as long as wide. Legs slender; hind tarsus 1.25× as long as hind tibia; hind basitarsus 5.3× as long as wide; basitibial area slightly elevated above surroundings, pigmented posterior carina almost reaches apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 lateral lobes broadly triangular with truncated ends, posterior projections very small (Fig. 77).—*Scape*, tibiae, tarsi and distal ends femora orange-brown, with darker suffusions on fore and mid tibiae and faint suffusions on scape; labrum and mandible medially amber; flagellum dark brown. T1–5 with narrow silver bands stained brown across anterior margin.—*Clypeus* with contiguous punctures except at extreme apex; scutum with dull sheen, moderately strong pit-reticulation and small, close punctures.—*Face* densely covered with long, erect, finely-branched, dull orange hair. Scutum openly covered with similar plumose hair; fore basitarsus with weak fringe, length < 2× width basitarsus.

Female (AM K.316556).—*Head* width 4.20 mm, body length 13.3 mm. Relative dimensions: HW 50, HL 40, UID 29, UFW 31, LID 31, DMA 31, HVO 4, WOC 14, MOD 3, OOD 8, IAD 9, ASD 4, AOD 8, ML 23, BMW 8, MSL 2.0, SL 15, SW 3, FL c. 36.—*Face* almost quadrate; inner orbits parallel; length malar space c. 0.25× basal mandibular width; clypeus transversely convex, slightly flattened basomedially, basal margin weakly concave; supraclypeal area with small tubercle marking end of frontal carina; flagellomere F1 relatively long (length 2.0× width); inner hind tibial spur with c. 7 coarse teeth; tarsal claws simple; pygidial plate with small emargination.—*Labrum* and fore basitarsi orange-brown; remainder of legs dark brown; mandible medially brown. T1–4 with narrow silver bands stained brown across anterior margin.—*Clypeus* densely punctate on a reticulate ground except openly punctured near apex; supraclypeal area densely punctate, some punctures coalescing to form irregular grooves. Scutum with dull sheen, pit-reticulation and small, close punctures.—*Face* with long, off-white, plumose hair, becoming pale orange tipped with dark brown near ocelli, dense on frons and in paraocular area, sparse on clypeus and supraclypeal area. Scutum closely covered with short, plumose, pale orange hair tipped with dark brown; hair of hind tibial scopa orange-brown with golden reflections, dark in basitibial area; prepygidial fimbria mid-brown.

Remarks. The holotype male has abnormal wing venation as described by Rayment (1931) and a female in the same collection, labelled "TYPE", Canowindra, NSW, agrees with Rayment's description of a female "allotype".

Similar to *T. fuscus* n.sp. and *T. orientalis* n.sp. from which males may be distinguished by the weak fringe rather than a plume on fore basitarsus and the shape of S7, while females may be distinguished from *T. fuscus* n.sp. and *T. orientalis* n.sp. by the relatively long F1 and the small tubercle on the suraclypeus.

Distribution. Tablelands and slopes of New South Wales (NSS, SB, SEH) (Fig. 117).

Trichocolletes tuberatus n.sp.

Figs 78, 118

Type. Holotype ♂, 78 km S Bourke (30.8189°S 145.8828°E), 18 Aug. 2008, M. Batley, *ex Swainsona affinis*, in AM K.291004.

Specimens examined. The holotype and the following. **New South Wales**: ♂, ♀, 70 km N Bourke, New South Wales (29.5136°S 145.8247°E), 6 Sep. 2007, M. Batley, *ex Swainsona microphylla*, AM (K.344816); 2♂, 2♀, 78 km S Bourke (30.7806°S 145.8633°E), 31 Aug. 2009, M. Batley, *ex Swainsona affinis*, AM (K.344819–22); ♂, 21 km E Cobar (31.5639°S 146.0708°E), 17 Aug. 2008, M. Batley, *ex Glycine canescens*, AM (K.344817). **Queensland**: ♂, 75 km E Cunnamulla (28.0458°S 146.4894°E), 23 Aug. 2008, M. Batley, *ex Swainsona microphylla*, AM (K.344818).

Diagnosis

Length c. 11 mm; eyes hairy; legs black; moderately wide, silver-white metasomal bands, ferruginous across anterior margin. Male pubescence usually pale orange-brown, especially on face.

Descriptions

Male (holotype).—*Head* width 3.75 mm, body length 11.3 mm. Relative dimensions: HW 50, HL 39, UID 33, UFW 33, LID 30, DMA 28, HVO 5, WOC 14, MOD 4, OOD 9, IAD 8, ASD 3, AOD 9, ML 20, BMW 8, MSL 3.0, SL 14, SW 3, FL c. 42.—*Eyes* hairy; face broad, inner orbits converging ventrally; length of malar area c. 0.38× basal mandibular width; marginal area of clypeus elongated (laterally, 0.16× as long as medial length of clypeus); middle flagellomeres c. 1.2× as long as wide. Legs slender; hind tarsus as long as hind tibia; hind basitarsus 4.8× as long as wide; basitibial area strongly carinate on posterior margin, anterior margin with sharp edge. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 (K.344818) with narrow rectangular lateral lobes and strong posterior projections (Fig. 78).—*Distitarsi* orange-brown; mandible deep orange-brown; labrum and flagellum ventrally brown. T1–5 with wide, silver bands.—*Clypeus* dull, strongly pit-reticulate and densely punctate except apically; marginal area polished. Scutum dull with strongly pit-reticulation obscuring punctures.—*Face* densely covered with long, finely-branched, pale orange hair. Scutum closely covered with long, plumose, pale orange-brown hair; fore basitarsus with long, white plume; anterior margin of hind tibia with close to open fringe of long, white hair.

Female (K.344819).—*Head* width 3.90 mm, body length 11.0 mm. Relative dimensions: HW 50, HL 36, UID 31, UFW 33, LID 32, DMA 33, HVO 4, WOC 15, MOD 4, OOD 7, IAD 9, ASD 3, AOD 10, ML 20, BMW 7, MSL 1.5, SL 15, SW 3, FL c. 31.—*Eyes* hairy; face approximately quadrate, inner orbits parallel; length malar space c. 0.2× basal mandibular width; clypeus gently convex transversely; marginal area of clypeus as for male; middle flagellomeres as long as wide; inner hind tibial spur with c. 7 long teeth; apex of basitibial area not elevated above surrounding area; hind tarsal claw only with small inner ramus; pygidial plate entire, gently convex but without distinct medial elevation.—*Distitarsi* orange-brown; mandible deep amber. T1–4 with silver bands of average width.—*Clypeus* strongly reticulate and densely punctate except at extreme ventral margin; frontal carina terminating in a small tubercle on supraclypeal area; scutal sculpture as for male.—*Face* with long, plumose, white hair, close on clypeus and supraclypeal area, dense in paraocular areas and on frons. Scutum closely covered with short, plumose, pale brown hair; metasoma sericeous; prepygidial fimbria pale brown.

Remarks. Sexes associated by unique presence of labral tubercle and two coincident collection events. Similar to *T. micans* n.sp. but distinguishable by tubercle on labrum.

Distribution. Western areas of southern Queensland and northern New South Wales (CP, ML) (Fig. 118).

Etymology. The specific name is a Latin adjective meaning with a tubercle, referring to the labrum.

Trichocolletes venustus (Smith)

Figs 1–2, 12, 79, 119

Lamprocolletes venustus Smith, 1862, p. 57 (male).
Paracolletes venustus.—Cockerell, 1907, p. 229.
Trichocolletes venustus.—Cockerell, 1913a, p. 273 (female).
Trichocolletes daviesiae Rayment, 1931, p. 164. **n. syn.**
Trichocolletes nigroclypeatus Rayment, 1929, p. 162. **n. syn.**

Lectotype designation. The male specimen in BMNH, Hym 17.a 503 is here designated as the lectotype of *T. venustus* (see remarks below).

Specimens examined. The lectotype of *T. venustus*, the holotypes of *T. daviesiae* ♂, Heathmont, Victoria, 30 Aug. 1930, ANIC and *T. nigroclypeatus* ♀, Daylesford, Victoria, Oct. 1929, ANIC and the following. **Australian Capital Territory**: ♀, Bulls Head repeater station (35.2322°S 148.4836°E), 26 Nov. 1994, G. V. Maynard & G. J. Davis, *Pultenaea and Daviesia*, MV (950112); ♀, 1.9 km S Condor Ck Bridge Rd Brindabella Ra, 11 Nov. 1993, G. J. Davis, *Daviesia mimosoides*, MV (930737); 11♂, 4♀, 1.9 km S Condor Ck Bridge Rd Brindabella Ra, 27 Sep. 1993, G. J. Davis & G. V. Maynard, off *Daviesia* and *Hardenbergia violacea*, MV; ♂, Pierces Creek Forrest, 29 Sep. 1993, G. J. Davis & G. V. Maynard, off *Hardenbergia violacea*, MV; ♂, Warks Rd (35.21°S 148.50°E), 9 Dec. 1992, G. Maynard, off *Daviesia eulicifolia*, MV; 2♂, Uriara SF (35.3444°S 148.8328°E), 10 Oct. 2001, M. Batley, AM (K.316571–72). **New South Wales**: ♂, Anna Bay (32.7728°S 152.0481°E), 16 Jul. 2001, M. Batley, AM (K.316570); ♂, Armidale Road (30.7642°S 151.3692°E), 10 Oct. 1999, M. Batley, AM (K.316565); 3♀, Berambing, 3 Oct. 1979 & 12 Oct. 1978, N. W. Rodd, AM (K.344594–96); ♂, ♀, 5 km NE Bilpin, 4–5 Sep. 1977, N. W. Rodd, AM (K.344576–77); 6♂, ♀, 6 km NE Bilpin, 11 Aug. 1977, 9 Sep. & 11 Oct. 1988, N. W. Rodd, AM (K.344565–71); 4♂, 7 km NE Bilpin, 23 Aug. 1977, N. W. Rodd, AM (K.344572–75); 3♂, 3♀, Bilpin (33.4814°S 150.5480°E), 9–21 Sep. 2005, M. Batley, AM (K.316573,86–88,93,94); 7♂, 4♀, Clarence, 28–31 Oct. 1979 & 4 Oct. 1988, N. W. Rodd, AM (K.344600–06,16–20); 2♂, ♀, Clarence (33.478°S 150.250°E), 20 Oct. 2002, M. Batley, AM (K.316579–81); ♂, 34 km NNE Coonabarrabran, 17 Sep. 1998, A. Sundholm & J. Bugeja, AM (K.344625–26); 2♂, ♀, Gibraltar Range NP (29.595°S 152.269°E), 27 Aug. 2007, M. Batley, AM (K.316599–600,609); 2♂, 100 km W Grafton, 22 Aug. 1992, N. W. Rodd, AM (K.344623–24); ♀, Haystack Ridge, 7 Nov. 1977, N. W. Rodd, AM (K.344591); ♀, Hazelbrook, 1 Sep. 1984, M. Dingley, AM (K.344611); ♂, Kentlyn (34.0475°S 150.8842°E), 31 Aug. 1999, M. Batley, AM (K.316564); ♀, Lansdowne, 26 Sep. 1984, N. W. Rodd, AM (K.344612); ♂, Mountain Lagoon, 9 Aug. 1977, N. W. Rodd, AM (K.344564); 4♂, ♀, Mount Banks (33.5881°S 150.3686°E), 24 Sep. 2002 & 5 Sep. 2003, M. Batley, AM (K.316574–6,85,86); 4♂, Mount Canobolas (33.3497°S 149.0164°E), 28 Sep. 2005, M. Batley, AM (K.316595–98); ♀, Mount Hay Road (33.6389°S 150.3983°E), 17 Oct. 1998, M. Batley, AM (K.316560); ♂, Mt Kaputar NP, 12 Nov. 1979, N. W. Rodd, AM (K.344607); 6♂, ♀, Mt Tomah, 8–18 Sep. 1977, N. W. Rodd, AM (K.344578–84); ♀, Mt Tomah, 5 Oct. 1977, N. W. Rodd, AM (K.344588); 2♀, Mt Tomah, 20–21 Oct. 1977, N. W. Rodd, AM (K.344589–90); ♂, Mt Tomah, 10 Sep. 1978, N. W. Rodd, AM (K.344593); ♂, Mt Tomah, 22 Oct. 1978, N. W. Rodd, AM (K.344596);

♂, Mount Wilson (33.5450°S 150.3356°E), 5 Sep. 2003, M. Batley, AM (K.316585); ♂, Mt Victoria, Oct. 1930, Wilson, F E., MV (16500); 2♂, 3 km S Mt Wilson, 15 Sep. 1979, N. W. Rodd, AM (K.344597–98); 2♂, ♀, 10 km W Murwillumbah, 17 Aug. 1982, N. W. Rodd, AM (K.344608–10); 2♂, ♀, Nadgee Reserve, 9 Sep. & 14–28 Oct. 1985, E. A. Sugden, AM (K.344613–15); 2♂, 8 km SE Narrabri (30.3994°S 149.8144°E), 25 Aug. 2009, M. Batley, AM (K.316610–11); ♀, 12 km SE Narrabri (30.4233°S 149.8511°E), 25 Aug. 2009, M. Batley, AM; ♂, ♀, Narrow Neck (33.7492°S 150.2800°E), 27 Sep. 2002, M. Batley, AM (K.316577–78); ♀, Ourimbah SF (33.3211°S 151.3519°E), 18 Aug. 2003, M. Batley, AM (K.316582); 3♂, Parramatta Park (33.7914°S 150.0100°E), 18 Aug. 1999, M. Batley, AM (K.316561–63); ♂, ♀, Parramatta Park (33.7914°S 150.0100°E), 16 Aug. 2000, M. Batley, AM (K.316566–67); 2♂, Parramatta Park, 14 Aug. 2009, M. Batley, AM (K.316612–13); 3♀, Pilliga NR (30.9364°S 149.4222°E), 13 Sep. 2005, M. Batley, *ex Pultenaea cinerascens*, AM (K.316589–91); ♂, Stanwell Tops, 27 Aug. 1978, G. Daniels, AM (K.344592); ♂, Tallong (34.7194°S 150.5639°E), 30 Sep. 2000, M. Batley, AM (K.316569); 3♀, Wolgan Valley, 21 Sep. 1977, N. W. Rodd, AM (K.344585–87). **Queensland**: ♂, ♀, Bardon, 29 Aug. 1974, K. Lambkin, UQIC; 3♂, ♀, Beeburrum-Woodford Rd (26.56°S 152.50°E), 8 Jul. 1991, G. V. Maynard, *ex Dillwynia*, UQIC; ♀, 14 km W Beerburrum (26.9419°S 152.8303°E), 25 Aug. 2008, M. Batley, AM (K.316601); 4♂, 2♀, Brisbane, 18 Aug. 1914, H. Hacker, QM; ♂, S of Eukey, 26 Sep. 1967, T. F. Houston, *Daviesia*, SAM (32-024505); ♀, 5 mls E Pikedale, 1 Nov. 1966, T. F. Houston, *Daviesia*, SAM (32-024493); 2♀, Mt Tamborine, 5 Oct. 1966, T. F. Houston, SAM (32-024497,99); 2♀, 17 mls S Warwick, 4 Nov. 1966, T. F. Houston, *Jacksonia scoparia*, SAM (32-024496). **South Australia**: ♂, 11 km S of Clare, 29 Sep. 1973, T. F. Houston, on *Daviesia corymbosa*, SAM (32-024572); ♂, ♀, Cape St Albans Kangaroo Is, 2 Oct. 1970, T. F. Houston, on *Swainsona lessertiifolia*, SAM (32-024571,74); ♂, 2♀, 6 mi E Karatta Kangaroo, 3 Oct. 1970, T. F. Houston, on *Goodia lotifolia*, SAM (32-024573,78,85); 3♂, 6♀, 8 mi S Kingscote Kangaroo Is, 1 Oct. 1970, T. F. Houston, on *Daviesia ulcina*, SAM (32-024575–77,79–82,84,86); ♂, Kyeema Nat Pk nr Meadows, 7 Oct. 1972, T. F. Houston, on *Daviesia corymbosa*, SAM (32-024570); 3♂, Mt Lofty, 6 Oct. 1963, SAM (32-024486–87,92); ♂, Mt Lofty summit, 16 Oct. 1964, T.F.H., on *Platylobium*, SAM (32-024485); ♀, Mt Lofty, 26 Oct. 1964, T.F.H, on *Platylobium*, SAM (32-024489); ♂, Mt Lofty summ, 23 Sep. 1965, T. Houston, on *Daviesia*, SAM (32-024490); ♂, Rocky River, Kangaroo Is, 4 Oct. 1970, T. F. Houston, on *Leucopogon*, SAM (32-024583); 2♂, Warren Nat Pk nr Kersbrook, 7 Sep. 1975, T. F. Houston, on *Daviesia*, SAM (32-024568–69); ♂, Rev A. P. Burgess, SAM (32-024587).**Tasmania**: ♂, Hobart, 26 Aug. 1917, MV (16493). **Victoria**: ♀, Ararat, MV (16495); 5♂, Bendigo, 10 Sep. 1922, Burns, Alec N., MV (16538–42); ♂, Black Rock, WAA (45308); 2♂, ♀, Black Sands, 16 Oct. 1936, ANIC; ♀, Croydon, 6 Sep. 1961, MV (16507); 2♂, 2♀, Ferntree Gully, 28 Sep. 1930, Burns, Alec N., MV (16508,11,12,16); ♂, Ferntree Gully, 17 Sep. 1927, Burns, Alec N., MV (16520); ♀, Grampians, Oct. 1928, Wilson, F E., MV (16492); 4♂, Heathmont, 23 Aug. 1930, Burns, Alec N., MV (16513,28,32,36); ♂, Heathmont, 16 Sep. 1945, Burns, Alec N., MV (16524); 2♂, ♀, Heathmont, 30 Aug.–1 Sep. 1930, Rayment, ANIC; ♂, Ringwood, Oct. 1929, MV (16491); 2♂, ♀, Ringwood, 30 Sep. 1930, Burns, Alec N., MV (16506,10,21); 2♂, Ringwood, 5 Sep. 1931, Burns, Alec N., MV (16509,31); ♂, 4♀, Sandringham, Rayment, BMNH; ♂, Sandringham, MV (16494).

Diagnosis

Eyes hairy; metasomal bands gold. Male mid tibia clear orange-brown; fore basitarsus with plume; anterior margin of hind tibia with open fringe of long hair (Fig. 2). Female clypeus with V-shaped basal margin; inner hind tibial spur with c. 8 teeth..

Descriptions

Male (AM K.316582).—*Head* width 3.90 mm, body length 12.5 mm. Relative dimensions: HW 50, HL 38, UID 28, UFW 29, LID 29, DMA 30, HVO 4, WOC 13, MOD 4, OOD 8, IAD 8, ASD 4, AOD 7, ML 19, BMW 7, MSL 1.5, SL 13, SW 4, FL c. 52.—*Eyes* hairy; face narrow, inner orbits parallel; length malar space c. 0.2× basal mandibular width; clypeus with V-shaped basal margin; flagellum as long as head width; middle flagellomeres c. 1.6× as long as wide. Legs slender; hind tarsus and hind tibia of equal length; hind basitarsus 4.5× as long as wide; basitibial area not evelated but posterior margin defined by pigmented carina reaching apex. Genital capsule similar to that for *T. orientalis* n.sp. (Fig. 37); S7 lateral lobes triangular, fused to base of ligulate processes, basal tooth obsolete, posterior projections moderately long (Fig. 79).—*Labrum*, scape, mandible medially, tarsi, tibiae and distal ends of femora orange-brown; flagellum ventrally dark brown; T1–5 with medium to wide gold bands.—*Clypeus* densely punctate except apically; scutum strongly reticulate with indistinct, close, fine punctures.—*Face* densely and scutum openly covered with long, plumose orange hair; fore basitarsus with long pale gold plume; trochanters and femora with much long pale hair; hind tibia with open, but conspicuous fringe of long, sparsely-branched, pale gold hair along anterior edge.

Female (AM K.316567).—*Head* width 4.00 mm, body length 12.0 mm. Relative dimensions: HW 50, HL 37, UID 28, UFW 31, LID 31, DMA 33, HVO 5, WOC 13, MOD 3, OOD 8, IAD 7, ASD 4, AOD 9, ML 22, BMW 7, MSL 1.5, SL 15, SW 3, FL c. 36.—*Eyes* hairy; face slightly wider than long, inner orbits weakly divergent ventrally; length malar space c. 0.25× basal mandibular width; clypeus convex, basal margin V-shaped; middle flagellomeres c. 1.2× as long as wide. Tarsal claws simple; inner hind tibial spur with c. 8 strong teeth; pygidial plate emarginate, sculptured, with medial elevation.—*Labrum*, mandible medially, tarsi, tibiae and distal ends femora orange-brown, with darker markings medially on fore and mid tibiae; remainder of legs, flagellum dorsally dark brown; flagellum ventrally brown; T1–4 with wide, gold bands.—*Clypeus* densely punctate and dull basally, sparsely to openly punctate and polished towards apex. Scutum strongly reticulate, with indistinct close fine punctures.—*Face* with long, plumose, pale hair becoming darker near ocelli, dense in paraocular area and on frons, open to sparse on clypeus and supraclypeal area. Scutum closely covered with short, plumose, dull orange hair; hair of hind tibial scopa orange except brown in basitibial area; prepygidial fimbria mid-brown.

Remarks. The original description of *Lamprocolletes venustus* (Smith, 1862) refers to dense pubescence covering the face and a ferruginous scape indicating unambiguously that the author was referring to a male specimen, not a female as stated. Baker (1993) located two possible syntypes of *Lamprocolletes venustus*, both males, one in the University Museum, Oxford, the other in the British Museum of Natural History. The British Museum specimen was examined and Mr James Hogan (OUM) confirmed that the Oxford specimen was the same species using photographs illustrating the diagnostic features.

Baker (1993) noted that his studies indicated that the designation "In the Collection of the British Museum" in Smith's original description might mean no more than that the species was represented in the collection and concluded neither specimen could be eliminated from consideration and both had been in Smith's possession at some time. He recommended that both specimens be regarded as syntypes and that the BMNH specimen be designated as the lectotype. Recognition that the male characteristics in the original description confirm that Smith misreported the sex of his specimen supports this view and accordingly we have adopted Baker's suggestion.

There was a small discrepancy in the labelling of the holotype of *T. nigroclypeatus*. A male and a female specimen were found carrying red *Allotype* and *Type* labels, respectively, together with identification labels in Rayment's hand. Collection information on the labels corresponded with details given in Rayment's original descriptions (Rayment, 1929, 1931) except that the date attached to the holotype (Oct. 1929) did not match that given in the original description (12/10/27). It is possible that the holotype was (re)labelled by Rayment when he designated the allotype. Both specimens are *T. venustus*.

Rayment (1931) refers to specimens of *T. venustus* from Western Australia when discussing bees in the collection of the Department of Agriculture of Western Australia. The only specimen of *T. venustus* found in that collection was from Black Rock, Victoria and no specimens bearing the collection data referred to by Rayment were found in that or any other collection. It is unlikely that the species occurs in Western Australia.

Distribution. Southeastern Australia including Tasmania (BBS, FLB, KAN, NAN, NET, NNC, NSS, SB, SCP, SEH, SEQ, TSE, VM) (Fig. 119).

Discussion

Subgenera. Most of the interspecific differences between females are small and matters of degree, while male sexual characteristics such as modified legs may be an unreliable indicator of relatedness. The female characters used to define the subgenus *Callocolletes* (Michener, 1965), and most of the extraordinary modifications of the male, occur individually in some of the newly described species. For reasons given in the remarks for *T. pulcherrimus*, we have chosen not to recognize this subgenus.

A group of thirteen species have hairy eyes, females with simple tarsal claws (minute inner rami in 2 cases) and males with similarly shaped S7. The remaining species show considerably greater variation in the shape of the male S7 and it may be that the thirteen species represent a relatively recent radiation. Their designation as a subgenus would, however, leave the remaining 27 species as a paraphyletic group and one that included three hairy-eyed species.

None of the species known to Michener (1965) had indistinct metasomal bands and hairy eyes, so he proposed a species group based on the absence of metasomal bands. The material now available contains one species with hairy eyes and indistinct metasomal bands and others that display intraspecific variation in the visibility of the metasomal bands.

The species pairs *T. chrysostomus* / *T. sericeus, T. leucogenys* n.sp. / *T. albigenae* n.sp., *T. brunilabrum* n.sp. / *T. micans* n.sp. and possibly *T. lacaris* n.sp. / *T. aeratus* n.sp. appear to be examples of species that have diverged on either side of the continent. It is less obvious why the rather similar Western Australian species *T. rufibasis* and *T. soror* n.sp. should have separated.

As the similarities that unite the genus greatly outweigh differences between any possible species groups it was decided that no subgeneric division is appropriate.

Flower visitation. Information about flower visitation (including that in Houston [2000]) was present on the labels of 53% of the specimens examined in this study. All but six species were recorded as visiting pea flowers (Fabaceae: Faboideae) and the number of recorded visits to other flower groups by these 34 species was 5% of all visits. This pattern is consistent with the idea that the bees are broadly oligolectic, but occasionally visit other flowers to obtain nectar, but no examination of pollen loads was performed. The other flower families visited were Aizoaceae, Amaranthaceae, Apocynaceae, Caesalpiniodeae, Dilleniaceae, Ericaceae, Goodeniaceae, Lamiaceae, Myoporaceae, Myrtaceae, Polygalaceae and Rutaceae.

Only for two of the species, *T. centralis* n.sp. and *T. soror* n.sp., did visits to flowers other than peas exceed 15% of all records. *Trichocolletes centralis* n.sp., with 25% non-pea visits, has a wide distribution across arid areas, which might account for an increased dependence on alternative nectar sources. The number of records for *T. soror* n.sp. (13 *versus* 85 for *T. centralis* n.sp.) is fairly small and the 23% non-pea visits may be statistical variation.

Host flowers were not recorded for the two known specimens of *T. avialis* n.sp., but the remaining five species may specialize in visiting other plant types. This is certainly true for *T. eremophilae* and *T. multipectinatus*, which have been found only on *Eremophila* species and have an elongated proboscis that would help them obtain nectar from these flowers (Houston, 1990). Whether they visit a limited number of flowers in order to obtain nectar (oligotropic) or pollen (oligolectic) or both, remains to be determined. The species *T. hackeri* has to date been collected in rainforest areas on the Eastern coast of Australia. Flower visits were recorded on only three occasions, each involving a different plant family, Apocyanaceae, Dilleniaceae and Myrtaceae. On one of those occasions, pollen collection from *Hibbertia scandens* was observed (MB pers. obs.). *Trichocolletes macrognathus* n.sp. has been observed visiting five different plant genera in three plant families or subfamilies, Fabaceae-Caesalpinioideae, Lamiaceae and Myrtaceae, but not pea flowers. There is no obvious relationship between the flowers visited and the unusual elongation of the malar area in this species. The final species, *T. luteorufus* n.sp., has been collected on only two occasions.

Rayment (1935) reported that *T. serotinus* n.sp. and *T. venustus* nest in the ground and gave brief descriptions of the nests. Three other species have been seen entering nests in the ground: *T. orientalis* n.sp. at Black Mountain, ACT (MB pers. obs.); *T. dowerinensis* at Boorabbin Rock, WA and *T. macrognathus* n.sp. at Wannoo, WA (TFH pers. obs.).

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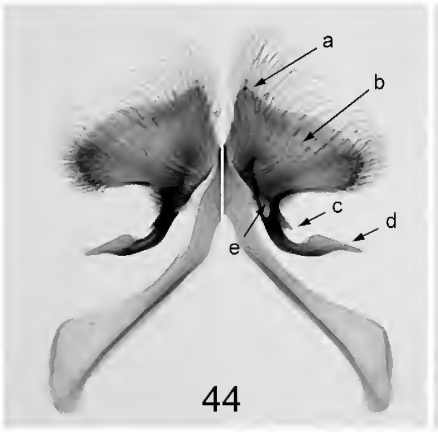
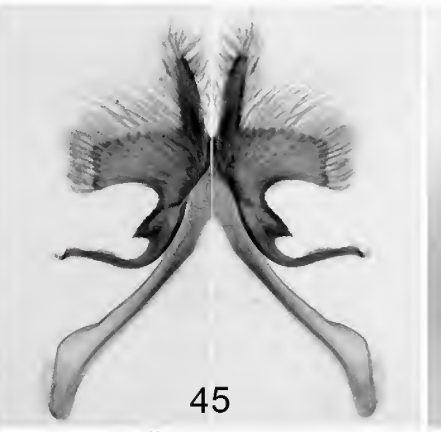
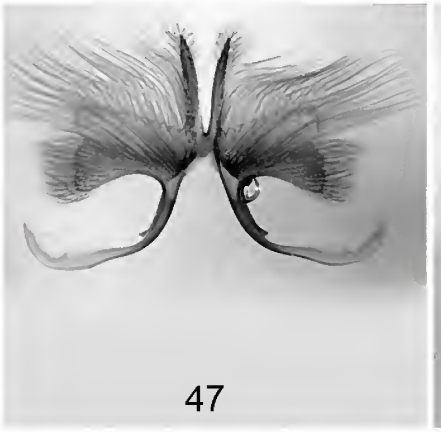


T. aeratus n.sp.

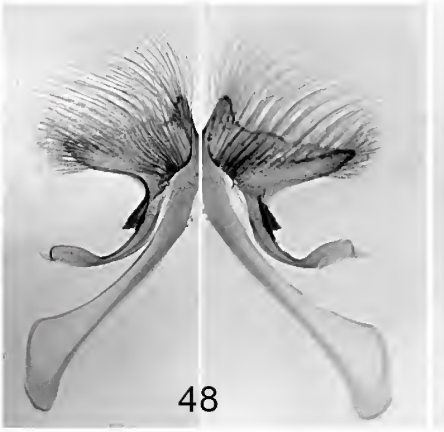


T. albigenae n.sp.

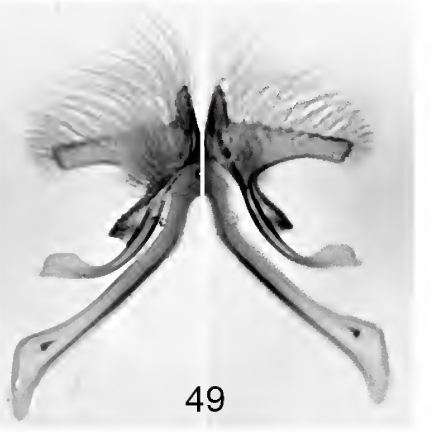
T. aureotinctus



T. avialis



T. brachytomus n.sp.

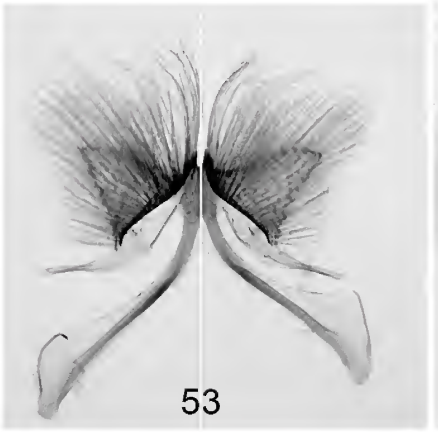


T. brunilabrum n.sp.

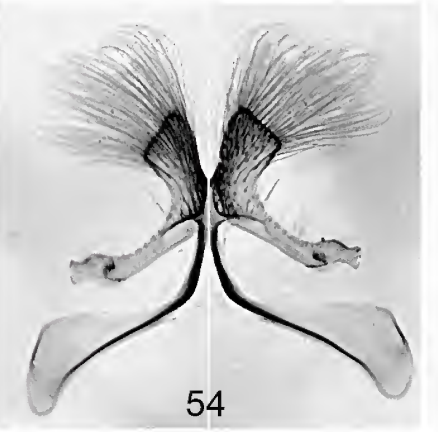
T. burnsi

T. capillosus n.sp.

T. centralis n.sp.



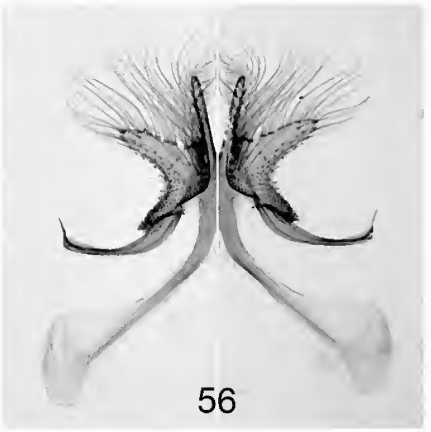
T. chrysostomus



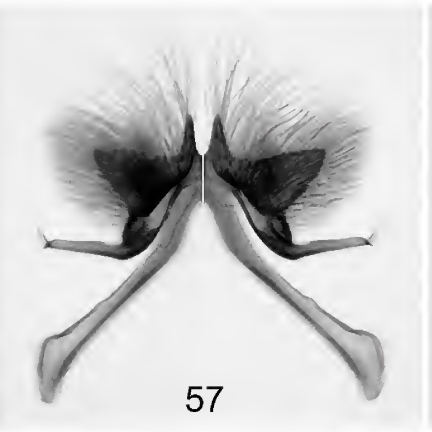
T. dives

T. dowerinensis

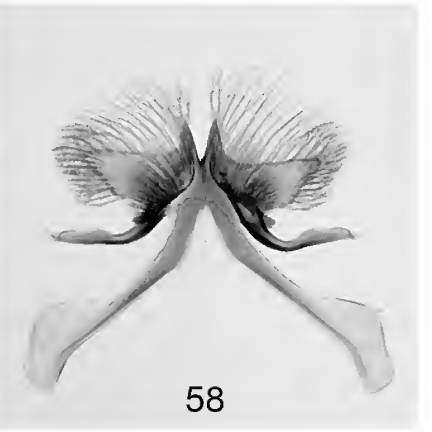
Figs 44–55. Seventh sternum of *Trichocolletes* males. The following features are labelled on Fig. 44: *(a)* posterior projection *(b)* lateral lobe *(c)* basal tooth *(d)* ligulate process *(e)* opening to hollow in lateral lobe.



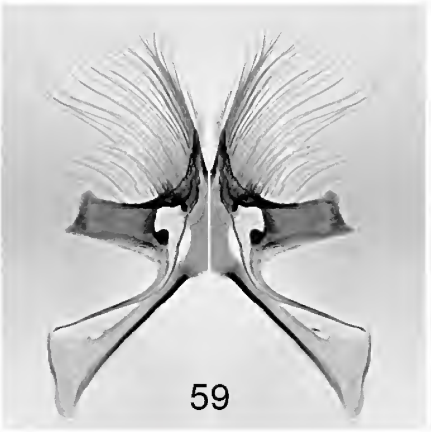
T. erythurus



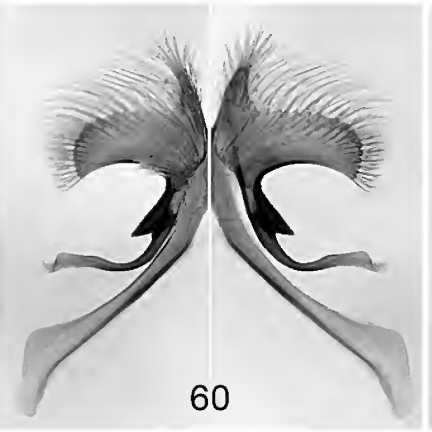
T. fuscus (extreme form A)



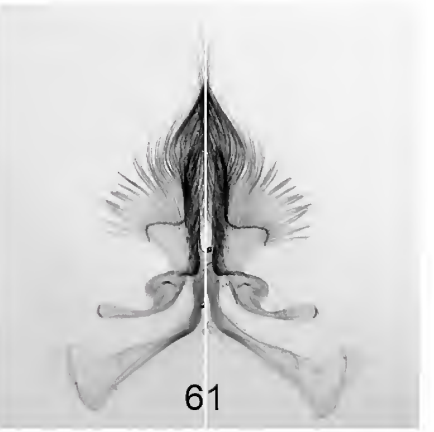
T. fuscus (extreme form B)



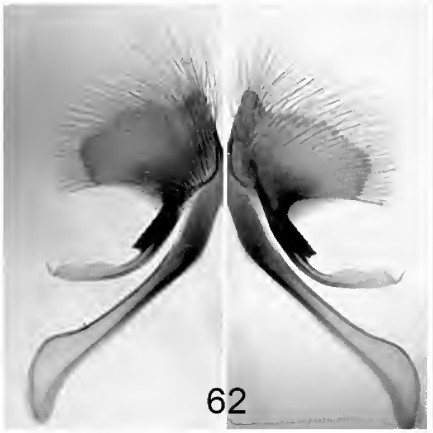
T. gelasinus n.sp.



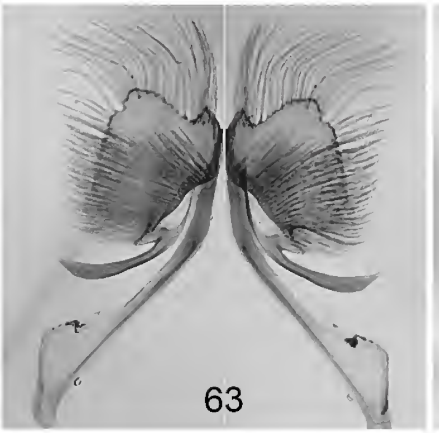
T. grandis n.sp.



T. hackeri

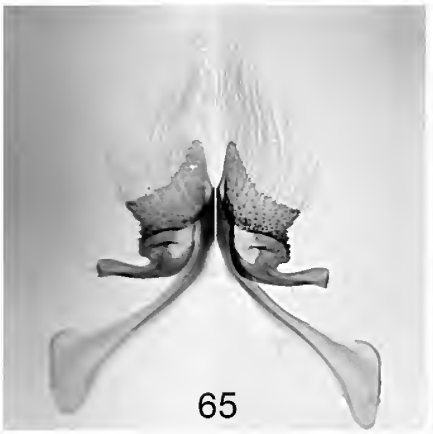


T. lacaris n.sp.

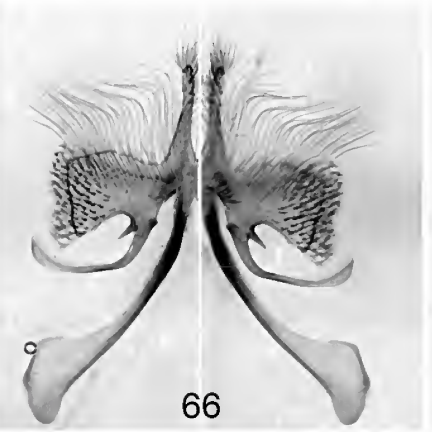


T. latifrons

T. leucogenys n.sp.



T. macrognathus n.sp.



T. marginatus

T. maximus

Figs 56–67. Seventh sternum of *Trichocolletes* males.

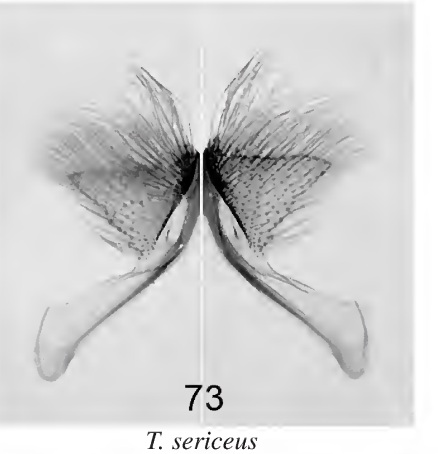
T. micans n.sp.

T. nitens n.sp.

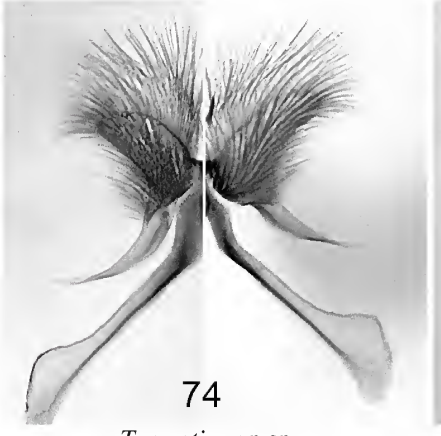
T. orientalis n.sp.

T. platyprosopis

T. rufibasis

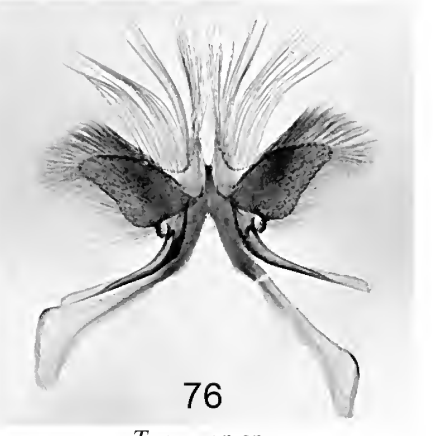


T. sericeus



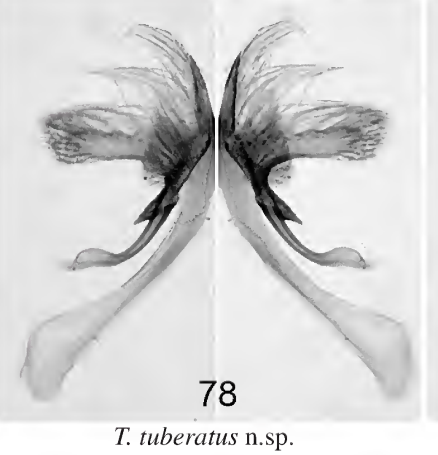
T. serotinus n.sp.

T. simus n.sp.



T. soror n.sp.

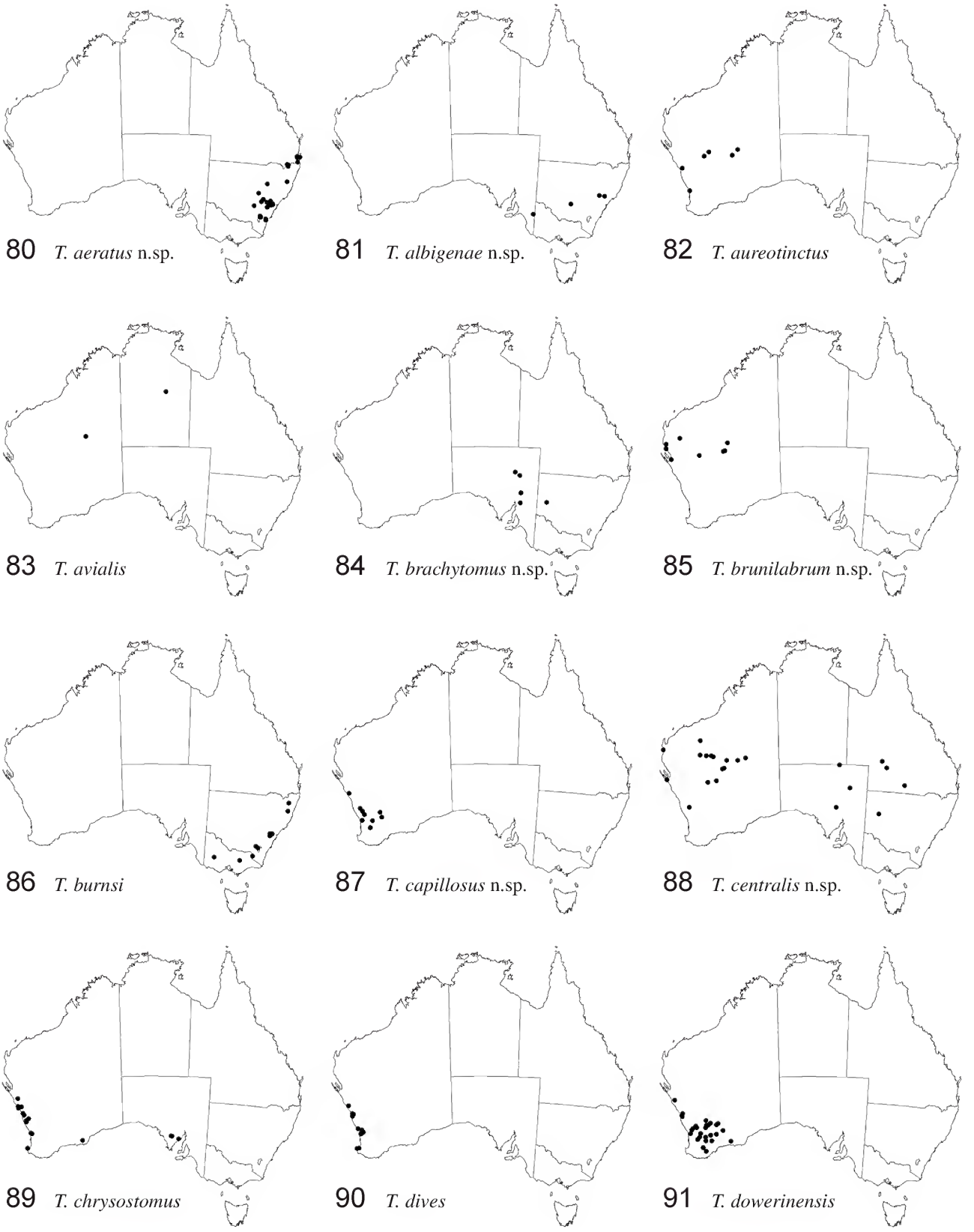
T. tenuiculus



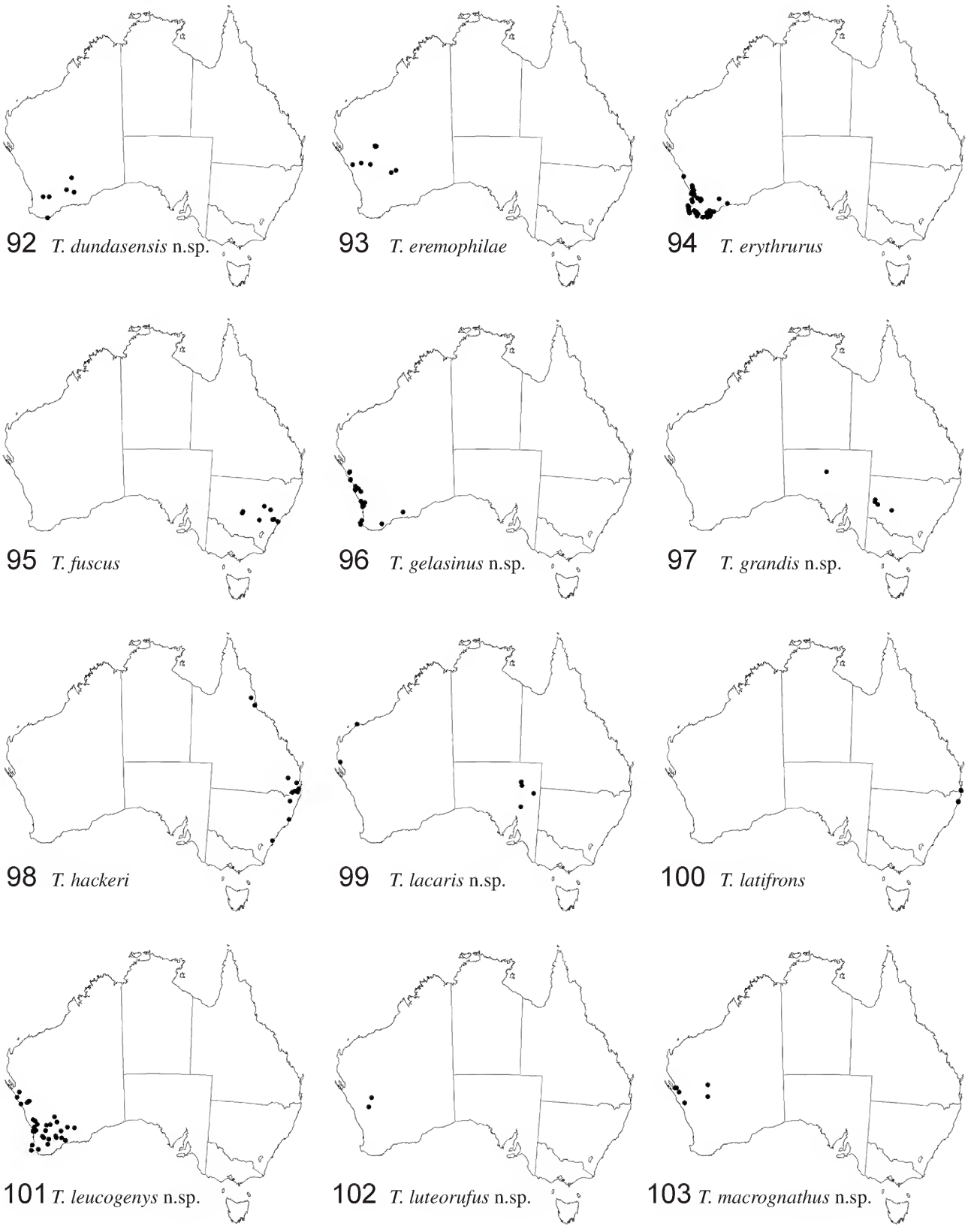
T. tuberatus n.sp.

T. venustus

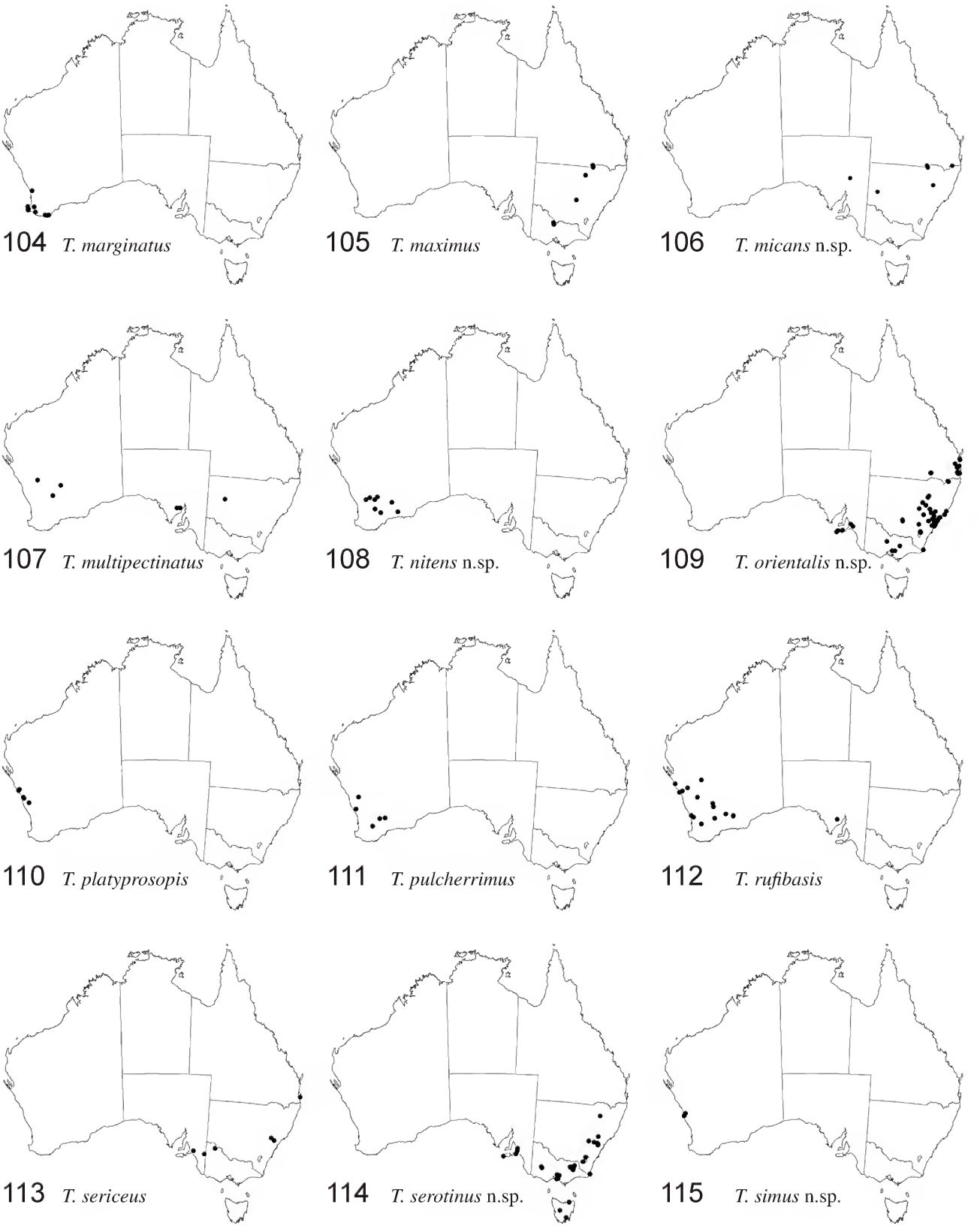
Figs 68–79. Seventh sternum of *Trichocolletes* males.



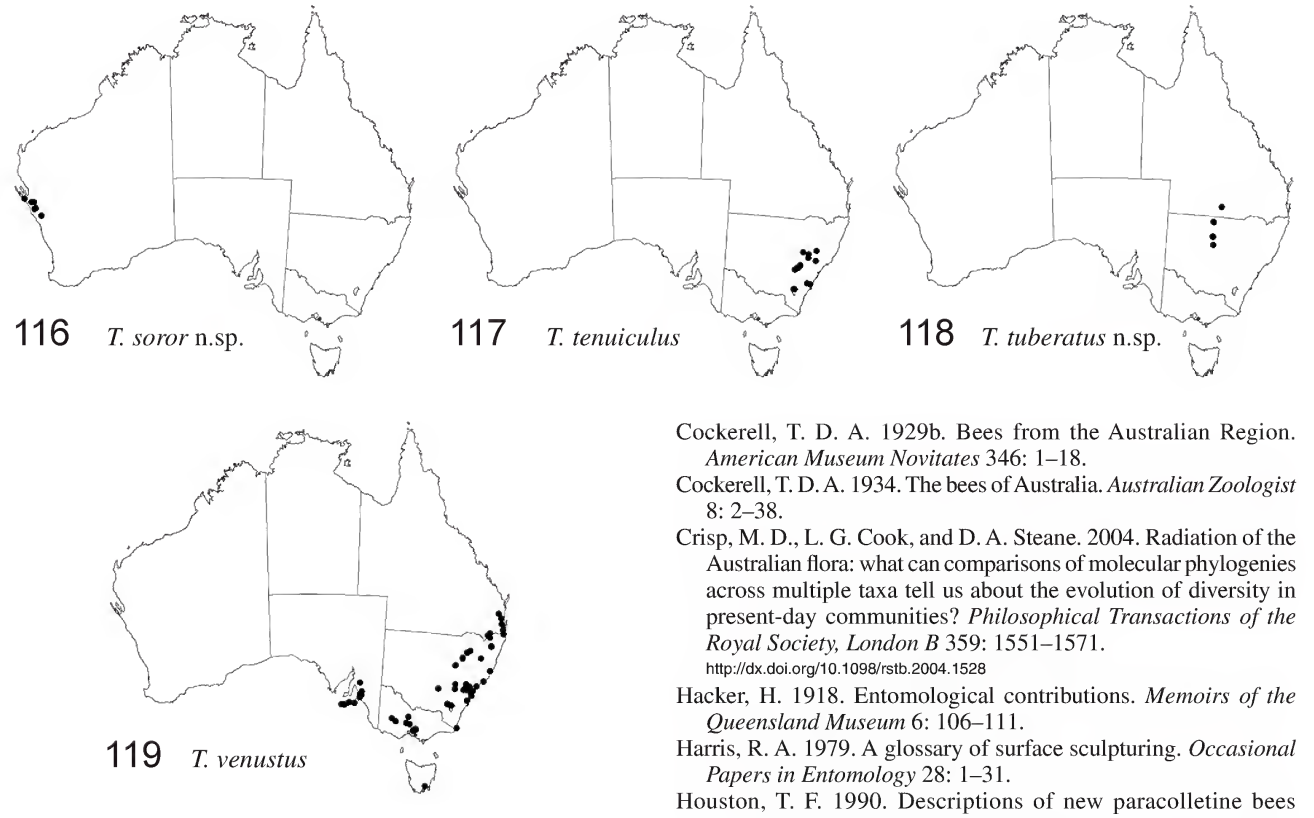
Figs 80–91. Known distribution of *Trichocolletes* species.



Figs 92–103. Known distribution of *Trichocolletes* species.



Figs 104–115. Known distribution of *Trichocolletes* species.



Figs 116–119. Known distribution of *Trichocolletes* species.

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Notes and Descriptions of Australian Helosciomyzidae or Comb-winged flies (Diptera: Schizophora)

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ABSTRACT. Notes on morphology, including costal features and sexual dimorphism, are given. Limited information on habitat and biology is noted. The Helosciomyzidae are compared with other families with which they have been sometimes associated (e.g., the Dryomyzidae, Sciomyzidae, and Huttoninidae). The position of the Neotropical genus *Sciogriphoneura* Malloch in the Helosciomyzidae, not the Dryomyzidae, is confirmed from strong morphological evidence; this leaves no evidence of the Dryomyzidae in the Southern Hemisphere. The nomenclature of the Australian taxa of Helosciomyzidae is revised with reference to type specimens of all previously described species. The new genus *Luta* is described. *Luta luteipennis* is a new combination for *Helosciomyza luteipennis* Steyskal. Keys to the Australian genera, species groups, and species are given. *Helosciomyza ferruginea* Hendel is a new junior synonym of *H. fuscinevris* (Macquart). The following new Australian species are described: *Helosciomyza bickeli*, *H. driesseni*, *H. neboissi*, *H. obliqua*, *H. steyskali*, *H. subacuta*, *Neosciomyza peckorum*.

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The family Helosciomyzidae, as most recently reviewed and delimited by Barnes (1981), was formerly included in the Sciomyzidae, though Steyskal (1965) had previously recognized the group at subfamily rank. The present study is needed to clarify the application of some older specific names and to name seven new Australian species.

The following collectors' names are abbreviated to the initials: D.J. Bickel, G.L. Bush, D.H. Colless, I.F. Common, B.J. Day, M.M. Driessen, E.D. Edwards, L.F. Graham, J. Kukalová-Peck, I.M. Mackerras, S.A. Marshall, D.K. McAlpine, I.D. Naumann, A. Neboiss, S.B. Peck, K.T. Richards, M.A. Schneider, W. Smith.

Institutions housing specimens are abbreviated as follows: AM, Australian Museum, Sydney; ANIC, Australian National Insect Collection, CSIRO, Canberra; MV, Museum Victoria, Melbourne; PM, Muséum national d'Histoire naturelle, Paris; QM, Queensland Museum, Brisbane; SAM, South Australian Museum, Adelaide; SPHTM, School of Public Health and Tropical Medicine, University of Sydney (collection now divided between AM and ANIC); TDPI, Department of Primary Industries, New Town, Tasmania; UQIC, University of Queensland Insect Collection, Brisbane (collection now held in the QM); USNM, National Museum of Natural History, Washington, D.C.; NMW, Natural History Museum, Vienna.

Habitat and biology

In my experience helosciomyzid flies are generally found in various forest or tall scrub habitats, but some exceptions have been noted. The very widely distributed *Helosciomyza fuscinevris* occurs in the Simpson Desert, Central Australia, as well as in some forest and suburban habitats. Most specimens of *H. driesseni* were collected in button grass moorland in the Tasmanian highlands. *Cobergius vittatus* is apparently restricted to seashore habitats, and some of its morphological features are shared with other shore-inhabiting flies, e.g., the reduced eye area, the predominantly greyish rather than

orange-brown coloration, and the conspicuously hirsute males. The locality data for *C. vittatus* suggest an association with fur seals (*Arctocephalus* spp.), but this is not yet confirmed.

Adult helosciomyzids may be collected by sweeping vegetation, but are generally sparse under field conditions and long series of specimens are rarely obtained. They are sometimes attracted to carrion (author's experience and label data from S.B.P. and J.K.-P.).

Steyskal and Knutson (1979) described the egg of "*Helosciomyza ferruginea*", but this involved a specific misidentification, the dissected female being referable to *H. bickeli*.

The few rearing records for helosciomyzids suggest a wide range of larval habits, but do not include molluscivory, which is typical of true sciomyzids. A series of *Eurotocus australis* was reared from larvae in agaric fungi in South Australia (Steyskal and Knutson, 1979). Barnes (1980a) recorded larvae of *Helosciomyza subalpina* Tonnoir & Malloch in New Zealand as predators of ant larvae and found that they fed on other freshly killed insects in the laboratory. Barnes (1980b) recorded larvae of *Polytocus costatus* Harrison from a seabird carcass in the Snares Islands.

Morphology and relevant terminology

I follow a traditional terminology with minimal use of terms implying doubtful, unproved, or, for present purposes, irrelevant homologies. Details are given by D. McAlpine (1973), with some additional terms given by D. McAlpine (1985, 2007). Most terms are also explained by Harrison (1959), Crosskey (1973), and Colless and D. McAlpine (1991). Terminology for the costal chaetotaxy follows Hackman and Väisänen (1985), but they omitted mention of the costagium.

I use the term lateral occipital suture for the suture separating the mesocranial plate or median sclerite from the lateral plate of the upper occipital region. With regard to the hind tibia, I distinguish the subapical anterior bristle from the preapical dorsal bristle (see Figs 1, 2), in accord with D. McAlpine (1991a: 32).

The costagium is a partly dilated or thickened setulose section of the costa (the thick vein on the anterior edge of the wing) near its base. It is particularly characteristic of the Cyclorrhapha, but is distinguishable in numerous other taxa. The term has been confused with basicosta, but I think that the latter term should be restricted to the part of the costal region between the tegula and the costagium. The basicosta is without setulae, though often with fine, pile-like microtrichia (Fig. 4; see also Crampton, 1942: fig. 7I, *bac*). At its distal end the costagium may gradually narrow into the humeral section of the costa, which connects with the humeral crossvein; or it may be separated from the latter section by a costagial break (J. McAlpine, 1981: fig. 69).

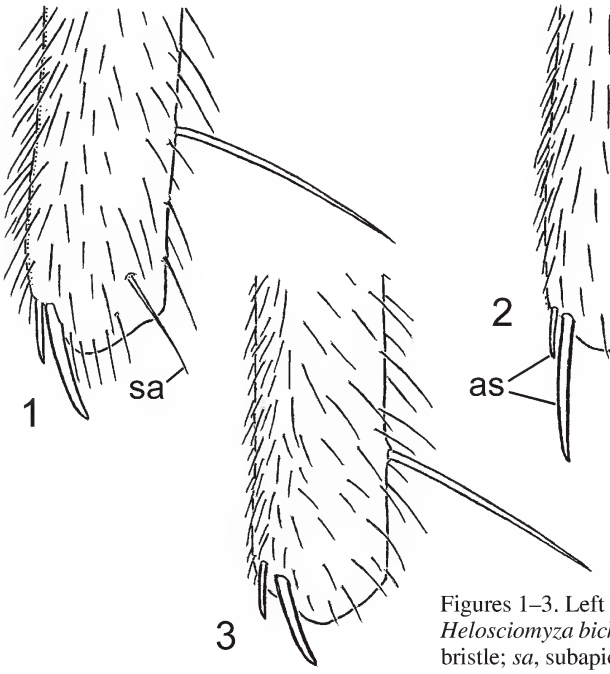
In the Helosciomyzidae, as in related families, there is no costagial break. The costagium bears a large anterodorsal bristle and a large anteroventral bristle, the latter bristle placed more distally (Fig. 4). This condition contrasts with that of the few taxa of Dryomyzidae now available to me, which lack the anterodorsal bristle, but is a common condition in numerous acalyptrate families. The basicosta consists of a short, flat anterodorsal plate and an anteroventral microtrichose tubercle.

Sexual dimorphism

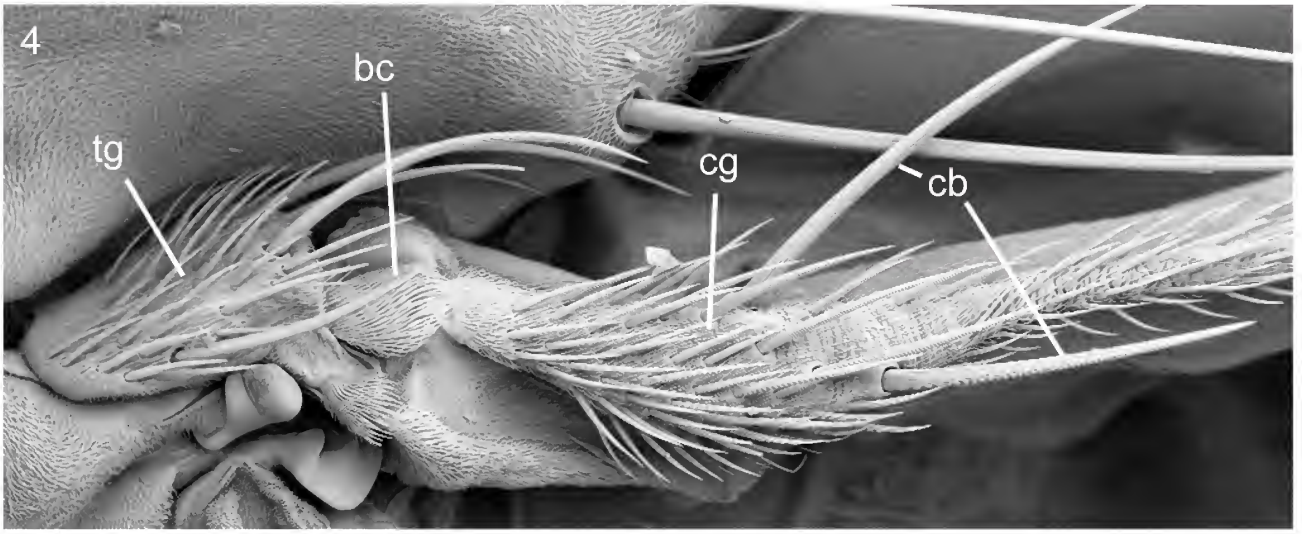
It is important to have some understanding of sexual dimorphism, in addition to that of postabdominal parts, in order to evaluate the taxonomic significance of certain characters, and to distinguish taxonomic differences from sexual differences (see D. McAlpine, 1992 in connection with *Cobergius*). Also, the nature of sexual dimorphism may indicate significant points in the biology of the insects, and may relate to mutual recognition by conspecific individuals (D. McAlpine, 1988).

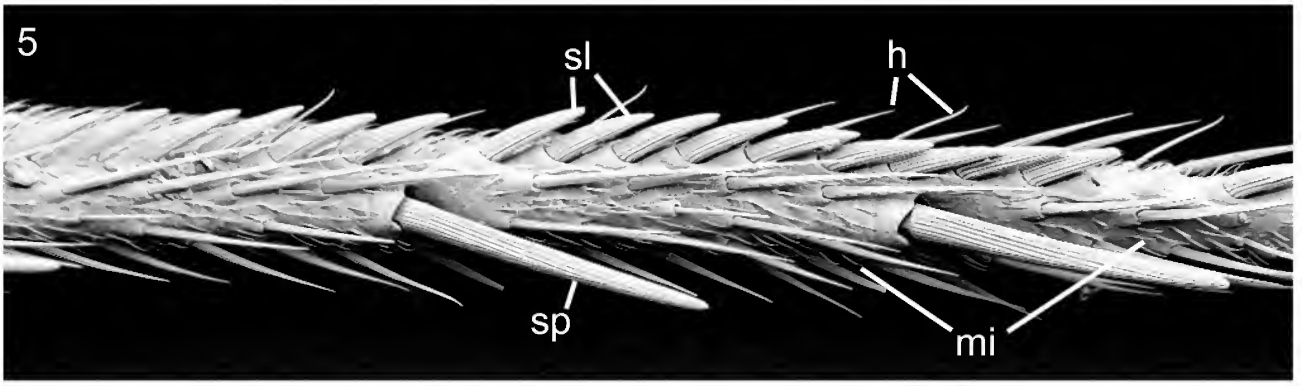
In flies of several schizophoran families the macrotrichia of some parts of the body are more numerous, longer, and finer in males than in females, and in the former they may have a tendency to be represented by mollisetae. Mollisetae are long macrotrichia (socket-based hair-like structures), which are strongly developed for part of the length, but are relatively thin and soft at their apices (D. McAlpine, 1991a). Mollisetae are present to a conspicuous extent in the males of certain species of Coelopidae, Helcomyzidae, Heteromyzidae, Piophilidae, and Scathophagidae. In some species of Helosciomyzidae larger numbers of mollisetae on the sternopleuron and fore femur of the males tend to replace the major bristles, which, however, remain well differentiated in conspecific females. Specimens of *Helosciomyza* spp. can be sexed solely by reference to the setulae on the ventral surface of the fore and hind femora, which are more numerous, finer, and more erect in males than in females.

The legs of male helosciomyzids are frequently stouter than in conspecific females. This is particularly noticeable in the femora. Also some or all of the tarsal segments are often shorter and broader in males than in females (Figs 6, 7).



Figures 1–3. Left hind tibia, anterior view of apical part. *(1) Neosciomyza peckorum. (2) Helosciomyza bickeli. (3) Cobergius vittatus*. *as*, apical ventral spurs; *pd*, preapical dorsal bristle; *sa*, subapical anterior bristle.



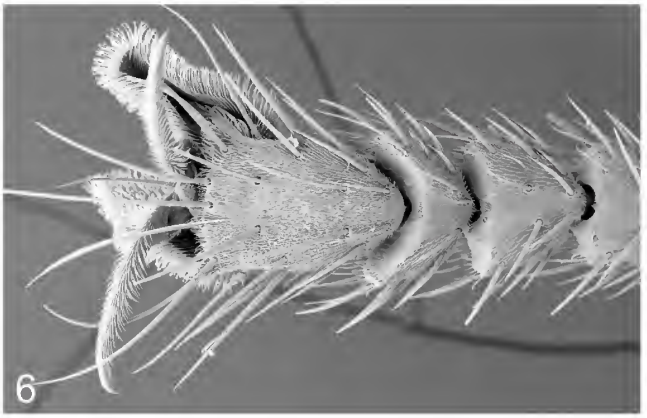


Figures 4, 5. *Luta luteipennis*, left wing. *(4)* anterior view of basal section. *(5)* anterior view of part of costa near end of subcosta. *bc*, basicosta; *cb*, costagial bristles; *cg*, costagium; *h*, hairs; *mi*, microtrichia; *sl*, spinules; *sp*, spine; *tg*, tegula.

I use the term scopula (as commonly used in Arachnology) to designate certain pad-like brushes of microtrichia on the ventral surface of some tarsomeres. The microtrichia comprising the scopulae are dense, longer and more erect than those forming the pruinescence of much of the cuticular surface, and are of remarkably even length, giving a velvety appearance (Figs 9, 10). These microtrichia differ from the tenent hairs of the pulvilli in being finely tapered apically, without the terminal adhesive discs.

I find scopulae to be developed to a varying extent on the fore and hind tarsi of males of all Australian genera and species groups of the Helosciomyzidae, also in the New Zealand genera *Napaeosciomyza* Barnes and *Dasysciomyza* Barnes, but they are probably least developed in *Luta luteipennis* and *Cobergius vittatus*. They reach their maximum development on the hind tarsus of males of *Neosciomyza anhecta* and *N. peckorum*; scopulae are present on all segments, and that on the basitarsus extends for its full length (Figs 8, 9). In females of probably all taxa scopulae are less developed than in males and are often vestigial.

In males of *Helosciomyza australica* and *Dasysciomyza* spp. the hind basitarsi have stout sub-basal ventral spines (strongly thickened black macrotrichia) which are absent in the females. The tarsal claws of male *Helosciomyza* spp.,



Figures 6, 7. *Helosciomyza macalpinei*, distal part of fore tarsus. *(6)* male. *(7)* female to same scale.

especially those of the fore-tarsus, are longer and less curved than those of the females (Figs 6, 7).

In males of *Helosciomyza fuscinevris* there is a group of minute setulae on the pleural membrane of the abdomen immediately behind and below spiracle 1. In females of the species these setulae are usually absent, but sometimes a few are present.

In the *fuscinevris* group of *Helosciomyza*, abdominal sternite 5 of the male is partly divided by median desclerotization and bears on each side a zone of particularly dense black setulae. No such division or specialized setulose zones are present in the female.

Taxonomy of Helosciomyzidae

The Helosciomyzidae are probably most closely related to the Dryomyzidae, which are restricted to the Northern Hemisphere, or perhaps to the Helcomyzidae, represented in both hemispheres but not in Australia (see Meier and Wiegmann, 2002 for probable phylogenetic relationships). The Helosciomyzidae can be separated from these related families by the following combination of characters.

1 Costa of wing with a series of large spaced spines near and beyond termination of subcosta (Fig. 5).
2 Costagial bristles two, anteroventral one located distad of anterodorsal one (Fig. 4).
3 Anal cell (cell cup) less than half as long as second section of vein 4 (between basal and anterior crossveins).
4 Anal crossvein (transverse section of CuA2) very strongly recurved.
5 Distal section of vein 6 (CuA2+A1) thickened on c. basal third or less, then becoming rather abruptly attenuated, but visibly reaching wing margin.
6 Prosternum without precoxal bridges.
7 Metasternum without setulae.
8 Three postgenal bristles generally differentiated (Fig. 13), except in occasional deviant individuals.
9 Tarsi with distal segments depressed.
10 Preabdominal spiracles located in pleural membrane.
11 In males, fore and hind basitarsi without rounded terminal ventral projection.
12 In females, abdominal tergites 3 to 5 without single enlarged lateral marginal bristle, with largest bristles on posterior margin.
13 In females, abdominal tergite 7 and sternite 7 separated by pleural membrane.

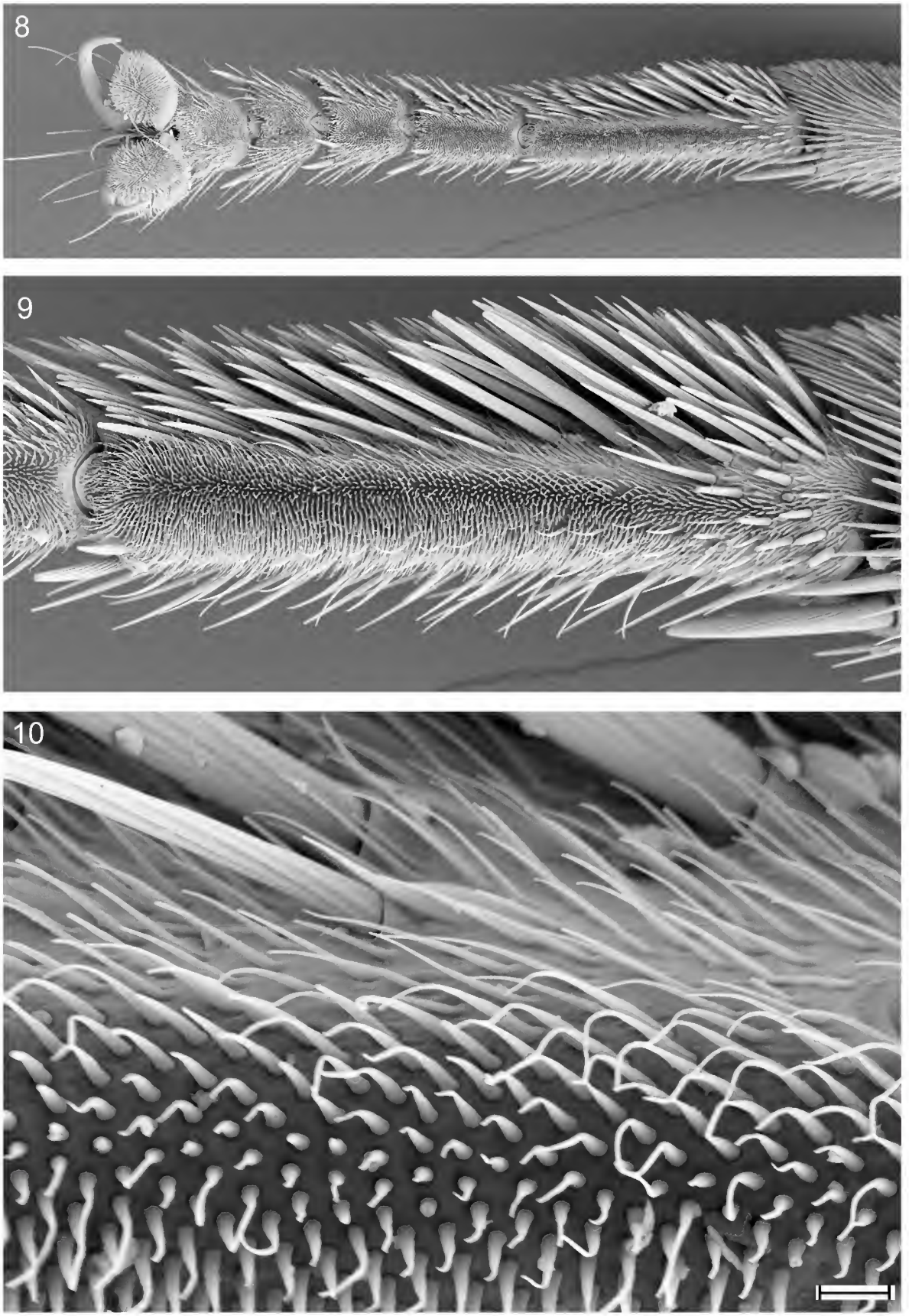
Most helosciomyzids have a distinct membranous line in the mid-dorsal region partly separating abdominal tergites 1 and 2, and Barnes (1981: table 1) has given this character as a distinction between "Helosciomyzidae sensu stricto" and "Dryomyzidae sensu stricto", which have this suture indistinct. However, in the helosciomyzid genus *Polytocus* Lamb there is no trace of such a suture, and in *Sciogriphoneura* Malloch it is reduced to a slight groove without desclerotization. The character is therefore omitted from the above list.

The Neotropical genus *Sciogriphoneura* Malloch was placed in the Dryomyzidae by Steyskal (1977) and in the Helosciomyzidae by Barnes (1981). My study of *S. nigriventris* Malloch, shows it to agree with the Helosciomyzidae in the first twelve of the numbered character states given above, except that one specimen shows asymmetrical variation in the number of postgenal bristles (character 8). In the only available female segment 7 is not visible, so that character 13 cannot be assessed. On the other hand, typical dryomyzids show disagreement in characters 1, 2, 3, 4, 5, 8, 9, 10, 11 (the last character inconsistently); but this assessment does not include the genus *Oedoparena* Curran, which I regard as doubtfully referable to Dryomyzidae. [The larvae of *Dryomyza* Fallén (objective syn. *Neuroctena* Rondani) and *Oedoparena* (see Ozerov, 1998, or, for more detail, Burger *et al.*, 1980, and Barnes, 1984) are so different in external form and structure that discovery of a strong set of synapomorphies is required to justify the inclusion of both taxa in one family]. Barnes (1981: 64) recorded that *Sciogriphoneura* possesses, in the male, both the anterior epandrial process and the basal surstylar process, as in many more plesiomorphic helosciomyzids, but the former is also present in typical dryomyzids.

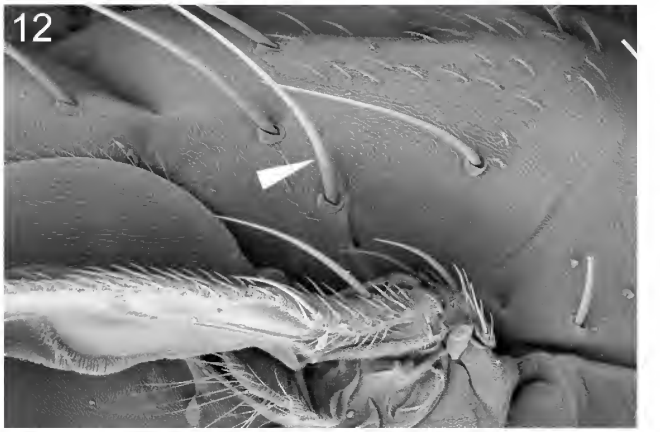
On the above basis I confidently assign *Sciogriphoneura* to the Helosciomyzidae. I believe that this correction, together with others made previously (D. McAlpine, 1995), leaves no valid record of the Dryomyzidae in the Southern Hemisphere.

Griffiths (1972) included the endemic New Zealand group, now called Huttoninidae, in the Helosciomyzidae, but Barnes (1979, 1981) considered that there were no clear synapomorphies to justify combining the two groups. Colless and McAlpine (1991) recognized the Huttoninidae as a separate family. The Huttoninidae are distinguished from the Helosciomyzidae by having: no spaced costal spines; distal section of vein 6 strongly sclerotized, but terminating abruptly at c. three quarters of distance to wing margin; vein 7 not forming a visible crease beyond alula; abdomen of female with tergite 7 and sternite 7 fused. Barnes (1979) also stated that the huttoninids differ in having the aedeagus bilobed, covered with fine scale-like structures. I am not at present in a position to test the consistency of this condition. The huttoninids generally have the ptilinal fissure less developed than in the helosciomyzids, though variable in extent and perhaps not always functional. In the Helosciomyzidae the ptilinal fissure apparently encloses a functional ptilinum, and its lateral arms are moderately long, usually ventrally diverging from the parafacial suture (terminating close to parafacial suture in *Scoiogriphoneura*). The Helosciomyzidae, in common with the Dryomyzidae, Helcomyzidae, Coelopidae, and Heterocheilidae, have the postalar callus of the mesoscutum convex, defined by an oblique depression or shallow groove on the anteromedian side, and bearing two large bristles (Fig. 11). In the Huttoninidae, as in the Lauxaniidae, the postalar callus has no separate convexity, and no oblique depression separates it from the general dorsal surface of the mesoscutum (Fig. 12); it bears a typical postalar bristle on its lateral angular prominence and the second, more dorsal bristle occupies the position of a typical posterior intra-alar bristle.

From Australasian taxa of Sciomyzidae, the Helosciomyzidae can generally be distinguished by having the prelabrum ("clypeus" in error) anteriorly prominent and only narrowly separated from the face (more reduced in the New Zealand genera *Napaeosciomyza* Barnes and *Dasysciomyza* Barnes), the costa with prominent spaced spines, and usually two large sternopleural bristles (anterior one sometimes reduced in very hirsute males). I have noted previously (D.



Figures 8–10. *Neosciomyza peckorum*, ventral views of male left hind tarsus. *(8)* entire tarsus. *(9)* detail of basitarsus showing scopula. *(10)* microstructure of scopula; scale = 10 µm.



Figures 11, 12. *(11) Luta luteipennis*, part of thorax showing right postalar callus. *(12) Huttonina abrupta* Tonnoir & Malloch, part of thorax showing right postalar region. Postalar bristle indicated.

McAlpine, 1991b) differences between the Helosciomyzidae and Heterocheilidae.

The Helosciomyzidae, in contrast to the Dryomyzidae, are restricted to the Southern Hemisphere. The majority of the 27 or 28 known species live in the temperate zone, but in both Australia and South America one species is recorded for the tropics. Of the 15 known Australian species, only two widely distributed species are recorded for Queensland, whereas at least eight species live in Tasmania, four of them possibly endemic to the state. Eleven species are recorded for New Zealand (Barnes, 1981), but it is uncertain if one of these is the same as an Australian species.

Key to Australian genera of Helosciomyzidae

1 Dorsocentral bristles four large pairs; costa near mid-length with spaced dorsal spines in addition to anterior ones; male: surstylus without posterobasal foot, with simple almost horizontal basal articulation with lateral margin of epandrium, and much removed from base of cercus posteriorly ..... *Eurotocus*, p. 57

—— Dorsocentral bristles usually two large pairs; costa with an anterior series of spaced spines only; male: surstylus with broad or narrow posterobasal foot, articulating with posterior margin of epandrium, and approaching base of cercus 2

2 Anterior bristle of hind femur absent, at least in male, small if present in female; sternopleuron on upper half or more with very generally distributed numerous fine hairs, sometimes forming long mollisetae in males; mesopleuron densely greyish pruinescent, without tawny orange zone; subapical anterior bristle of hind tibia absent or much smaller and thinner than preapical dorsal bristle (Figs 1,3) 3

—— Anterior bristle of hind femur large (sometimes duplicated); sternopleuron on upper part usually with narrower oblique tract of hairs, leaving bare anterodorsal and posterior zones; mesopleuron generally with tawny orange zone on mid or upper part; subapical anterior bristle of hind tibia present, about as stout as preapical dorsal bristle, though shorter (Fig. 2) 4

3 Scutellum concave mid-dorsally; antennal segment 3 short, subcircular; antennal segment 5 (preapical segment of arista) rounded, not much longer than its maximum diameter; male: hind basitarsus without scopula, with dense ventral setulae ..... *Cobergius*, p. 69

—— Scutellum convex dorsally; antennal segment 3 rounded oval, markedly longer than deep; antennal segment 5 cylindrical, c. twice as long as its diameter; male: hind basitarsus with dense ventral scopula for almost whole length (Fig. 9) ..... *Neosciomyza*, p. 68

4 Halter with brown capitellum; antennal segment 2 black (dark brown in faded specimens); height of cheek not more than 0.25 of height of eye; wing membrane deep yellow; male postabdomen:

anterior epandrial process and basal surstylar process present; aedeagus without epiphallus ..... *Luta*, p. 57

—— Halter entirely yellow; antennal segment 2 tawny-brown; height of cheek greater than 0.25 of height of eye; wing membrane usually less distinctly pigmented, except sometimes for suffusion around cross-veins; male postabdomen: anterior epandrial process and basal surstylar process absent; aedeagus with elongate epiphallus ..... *Helosciomyza*, p. 58

Genus *Eurotocus* Steyskal

Eurotocus Steyskal, in Steyskal & Knutson, 1979: 728. Type species (original designation) *Eurotocus australis* Steyskal.

This monotypic genus is distinguished as indicated in the key to genera.

Eurotocus australis Steyskal

Fig. 13

Eurotocus australis Steyskal, in Steyskal & Knutson, 1979: 728–730, figs 1, 3–6, 28–33, 38, 39 (not figs 36, 37 as listed by Steyskal); Barnes, 1981: 53–54, figs 7, 8.

Type material (re-examined D.K.M.). Holotype ♂. Victoria: Mount Baw Baw, near Tanjilbren, 4400 ft [c. 1340 m], 30.xi.1964, G.L.B.–64132 (AM K264608). Postabdomen in micro-vial on pin. Allotype ♀. Victoria: same data as holotype (AM). Paratypes. South Australia and Victoria: see list of Steyskal and Knutson (1979) (AM, SAM).

Other material examined (localities only given). Victoria: Lake Mountain (MV); Mount Donna Buang, near summit (AM). New South Wales: 5.6 km W of Perisher Valley, Kosciuszko National Park (AM).

Distribution. Victoria: mainly mountainous areas. South Australia: Adelaide and southeastern districts. New South Wales: Snowy Mountains district.

Notes

Steyskal and Knutson (1979) described the puparium of this species, and recorded the larvae as found in agaric fungi at Adelaide by Adolfo Lutz in 1892, perhaps during a brief stop-over by that Brazilian entomologist.

Genus *Luta* n.gen.

Type species: *Helosciomyza luteipennis* Steyskal.

Description. Moderately large, robust flies for family, agreeing with *Helosciomyza* s.str. in most characters.

Head slightly longer than high; height of cheek generally slightly less than one quarter of height of eye; cheek anteriorly usually with only the one peristomial series of setulae. Antennal segment 2 black (unfaded specimens); segment 3 largely black, rounded-oval; segment 5 subcylindrical, c. twice as long as its diameter.

Thorax. Dorsocentral bristles two pairs; scutellum convex dorsally, with two pairs of bristles; upper part of sternopleuron with relatively few hairs (or long setulae) on central section, bare anteriorly and posteriorly. Mid femur with non-seriate anterior bristles of various sizes; hind femur with two or more anterior to anterodorsal bristles; fore tarsus stouter in male than in female, with segment 4 not as short as in *Helosciomyza fuscinevris* group; fore tarsal claws notably longer in male than in female; hind basitarsus of male without scopula, with an anteroventral series of short stout spinules extending for most of its length, these spinules less developed in female. Wing: costa with anterior spaced spines; dorsal series of spines absent. Halter with yellow pedicel and brown capitellum.

Male postabdomen. Anterior epandrial process and basal surstylar process present; epiphallus absent (see Steyskal & Knutson, 1979: figs 19–21).

Notes

The genus includes only *Luta luteipennis*.

Barnes (1981) included *L. luteipennis* in the genus *Neosciomyza*, but it appears that the points of resemblance are mainly plesiomorphies, or, in the case of the convex scutellum, also shared with a relatively isolated species in the genus *Helosciomyza*, *H. anaxantha* Steyskal.

Luta is further distinguished from *Neosciomyza* by the following characters: the anterolateral margin of the epandrium is flexed inwards on each side to form a well defined crescentic plate lying in a transverse plane, the surstylus is narrowed basally and is without an internal ridge defining the basal plate, the basal surstylar process is short and stout, and the anterior epandrial process has a thick blunt apex with a brush of dense, curved pubescence.

Probably *Luta* is most closely related to *Helosciomyza* as delimited here and by Barnes (1981), but it lacks the apomorphic conditions of the male postabdomen, which help to define the latter genus.

The generic name is derived from the name of the type species and is grammatically feminine.

Luta luteipennis (Steyskal) n.comb.

Figs 4, 5, 11

Helosciomyza luteipennis Steyskal, in Steyskal & Knutson, 1979: 736, figs 19–22.

Neosciomyza luteipennis (Steyskal).–Barnes, 1981: 61–63, figs 30, 31.

Type material (re-examined D.K.M.). Holotype ♂. New South Wales: Mount Wilson, Blue Mountains, 11.xii.1959 (not 1969 as given by Steyskal), D.K.M. (AM K264312). Double-mounted on micro-pin through polyporus, repaired with glue on thorax. Allotype ♀, same data as holotype. Paratypes. New South Wales: Mount Wilson and Wright's Lookout, as listed by Steyskal (AM, ANIC).

Distribution. New South Wales: higher mountains of Northern and Central Tablelands districts.

Notes

At Mount Wilson, Blue Mountains, I have repeatedly found *L. luteipennis* in small numbers in shaded areas in the temperate rain forest, altitude c. 900 m, mainly in the months from October to April.

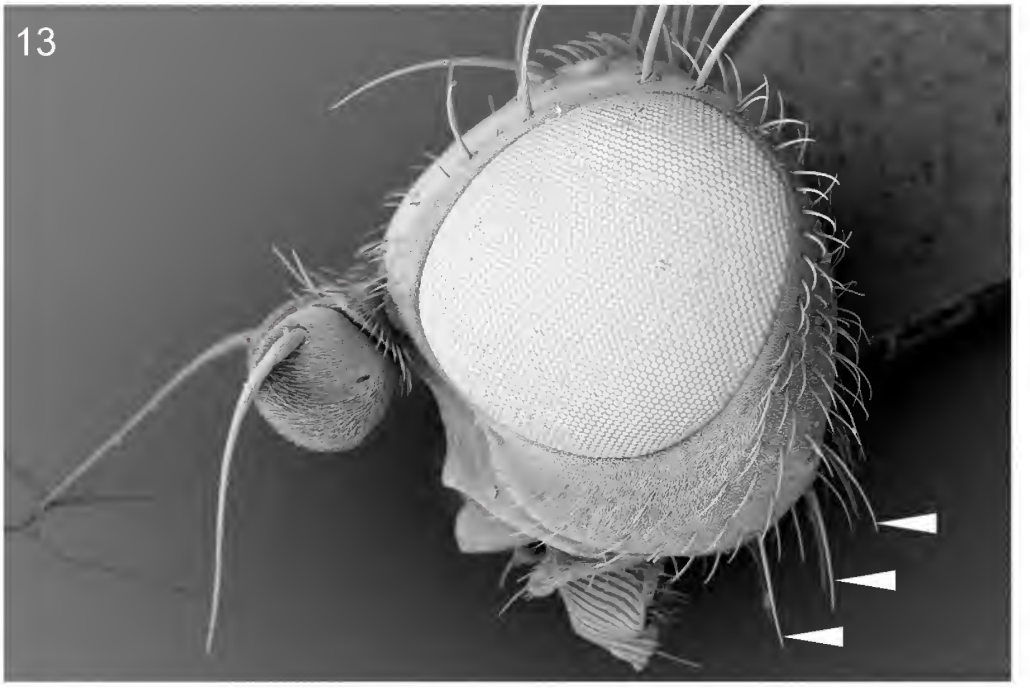


Figure 13. *Eurotocus australis*, head of female. Three postgenal bristles indicated.

Genus *Helosciomyza* Hendel

Helosciomyza Hendel, 1917: 3. Type species (monotypy): *H. ferruginea* Hendel [= *Helosciomyza fuscinevris* (Macquart)].

Notes

Helosciomyza is characterized as indicated in the above key, but is particularly justified by the following three apomorphic conditions of the male postabdomen, not simultaneously present in other Australian genera: (1) anterior epandrial process absent; (2) basal surstylar process absent; (3) elongate, freely projecting epiphallus present on aedeagus.

Key to species groups in *Helosciomyza*

1 Scutellum convex dorsally; anterior (r-m) crossvein without trace of infuscation; palpus dark grey to black on c. distal half; mesoscutum without pattern of grey longitudinal stripes; male: segment 4 of fore tarsus subtriangular and longer than wide; abdominal sternite 5 with setulae not concentrated in two dense patches ..... *anaxantha* group, only species *H. anaxantha*, p. 58

—— Scutellum flat dorsally; anterior crossvein infuscated, surrounded by brown mark (in unfaded specimens); palpus usually almost entirely yellow; mesoscutum (in clean, dry specimens) tawny, with pattern of five pale grey-pruinescent longitudinal stripes (two outer ones of each side partly joined), in addition to pale greyish lateral marginal zones; male: segment 4 of fore tarsus very short, its dorsal surface subcrescentic (Fig. 6); abdominal sternite 5 with short dense setulae forming two patches ..... *fuscinevris* group, p. 59

Helosciomyza anaxantha species group

This group is characterized as indicated in the above key. It resembles the genera *Luta* and *Neosciomyza* in the convex scutellum and less shortened segment 4 of the male fore tarsus, but lacks the anterior epandrial process and the basal surstylar process, both present in the males of those groups. Usually there are just two pairs of dorsocentral bristles but one specimen has three well-developed pairs. Among Australian helosciomyzids, the combination of dorsally convex scutellum with absence (without trace) of the proepimeral bristle occurs only in this group.

The only included species is *H. anaxantha* Steyskal.

Helosciomyza anaxantha Steyskal

Helosciomyza anaxantha Steyskal, in Steyskal & Knutson, 1979: 731–733, figs 11, 12; Barnes, 1981: 54–56, figs 9, 10.

Type material (re-examined D.K.M.). Holotype ♂. Tasmania: Hellyer Gorge, Waratah Highway, 8.i.1960, D.K.M. (AM K263391). Glued to card point, much damaged and badly repaired. Postabdomen in micro-vial on pin. Paratypes. Tasmania: 1♂, 2 mi. (c. 3.2 km) S of Oonah, Waratah Highway, c. 1300 ft (c. 400 m), 7.i.1960, D.K.M. (AM); 1♂, Russell Falls, Mount Field National Park, 13.i.1960, D.K.M. (AM); 1♂, Hartz Mountains, 800 ft (c. 240 m), 20.i.1960, D.K.M. (AM).

Other material examined. Tasmania: 2♂♂, 1♀, Mount Wellington, lower slopes, wet forest, 12.ii.1963, D.H.C. (ANIC).

Distribution. Tasmania: apparently widely distributed but endemic to the state. The record for Australian Capital Territory (Black Mountain, in Steyskal & Knutson, 1979: 732) is due to a misidentification (see under *Neosciomyza peckorum*).

Helosciomyza fuscinevris species group

This is a very uniform grouping, except for some minor features of chaetotaxy, and is characterized as in the above key.

Included species are: *Helosciomyza fuscinevris* (Macquart) (synonyms *H. ferruginea* Hendel, *H. aliena* Malloch), *H. subalpina* Tonnoir & Malloch (New Zealand only), *H. bickeli* n.sp., *H. subacuta* n.sp., *H. neboissi* n.sp., *H. australica* Steyskal, *H. steyskali* n.sp., *H. obliqua* n.sp., *H. driesseni* n.sp., *H. macalpinei* Steyskal.

Key to Australian species of *fuscinevris* group

1 Pteropleuron (anepimeron) setulose; hind tibia without dark zone near base; male: abdominal pleural membrane with group of minute setulae near spiracle 1 (often absent in female); surstyli as in Figs 16, 17 (slightly variable) ..... *fuscinevris*, p. 60

—— Pteropleuron bare; hind tibia usually with brown to black sub-basal or basal zone; no setulae present near abdominal spiracle 1 (male, female); male surstylus variable in shape 2

2 Hypopleuron (metepisternum) with c. 2–12 small black setulae; abdominal sternite 1 setulose; antennal segment 3 tawny-orange, without or with very indistinct darker zone; male: surstylus as in Fig. 15 ..... *bickeli*, p. 60

—— Hypopleuron and sternite 1 without setulae; antennal segment 3 often with darker brown to blackish zone; male: surstylus variable 3

3 Fore femur entirely pale tawny-yellow on basal half or more (significantly including the sometimes concealed anterior surface) 4

—— Fore femur largely tawny-yellow, anterior surface with distinct brown zone extending to near base (also brown distally) 6

4 Antenna 3 brown to blackish on entire distal half or more; male: hind basitarsus with ventrobasal dense, non-linear cluster of short, thick, black suberect spinules; surstylus as in Fig. 22 ..... *australica*, p. 64

—— Antenna 3 usually tawny orange at and below apex, more brownish dorsally between apex and aristal insertion and on outer lateral surface; male: hind basitarsus without such cluster of short, black spinules, occasional black setulae in this position sparse and distally inclined; surstylus otherwise 5

5 Fore femur with conspicuous dark brown subapical spot on posterior surface; mesoscutum with pruinescent dorsocentral stripe not covering and emphasized by a darker cuticular dorsocentral stripe (pruinescent stripe faded in some preserved specimens); male: surstylus as in Fig. 21 ..... *neboissi*, p. 63

—— Fore femur with only indistinct indication of dark subapical posterior spot (dark subapical anterior spot well developed); grey-pruinescent dorsocentral and other such longitudinal stripes of mesoscutum with underlying dark brown cuticular stripes, which tend to remain when pruinescent stripes are faded; male: surstylus as in Fig. 18 ..... *subacuta*, p. 63

6 Antenna 3 tawny-orange, with only limited dorsal reddish brown zone; male: surstylus as in Fig. 23 ..... *steyskali*, p. 64

—— Antenna 3 dark brown to blackish on distal half or more, or at least on a substantial dorsal zone (sometimes less, as in *H. driesseni*); male: surstylus otherwise 7

7 Occipital region of head with broad supracervical zone of blackish cuticle (seen through paler pruinescence) usually with, on each side, a dorsolateral extension partly bounded medially

by lateral occipital suture (Fig. 27); male: surstylus somewhat elongate-falcate (Fig. 25) ..... *driesseni*, p. 67

—— Supracervical cuticular dark zone less developed, not extending laterad of lateral occipital suture; male: surstylus otherwise 8

8 Proepimeral (stigmatal) bristle usually absent (check both sides); fore femur in posterior view usually showing rather diffuse dark greyish sub-basal posterodorsal zone and quite separate less diffuse dark subapical zone, on anterior surface sub-basal and distal brown zones usually separate; male: epandrium, in profile, without angular extension behind and above articulation with surstylus; surstylus as in Fig. 26 ..... *macalpinei*, p. 67

—— Proepimeral bristle usually present, small; fore femur usually without two such separate dark zones on posterior surface, on anterior surface sub-basal and distal brown zones touching or fused; male: epandrium, in profile, showing angular prominence behind articulation with surstylus; surstylus as in Fig. 24 ..... *obliqua*, p. 66

Helosciomyza fuscinevris (Macquart)

Figs 16, 17

Sciomyza fuscinevris Macquart, 1851: 276–277. Not homonym of *Sciomyza fuscinervis* Zetterstedt, 1838, now in *Tetanocera* Duméril.

Helosciomyza ferruginea Hendel, 1917: 33. N.syn. Not *H. ferruginea*: Steyskal, 1979: 736, mixture of other species.

Helosciomyza aliena Malloch, 1928: 324–325, synonymized D. McAlpine, 1992: 90.

Helosciomyza fuscinevris (Macquart).—D. McAlpine, 1992: 90.

Type material. Holotype ♂ of *Sciomyza fuscinevris*, Nouvelle-Hollande [New Holland = continental Australia, east coast added in publication—Macquart, 1851], anon. (PM, examined by D. McAlpine, 1990). Holotype ♂ of *Helosciomyza ferruginea*, Victoria, 1888 (NMW, examined by D. McAlpine 1969, P. Sehnal 2008). Holotype ♂ of *Helosciomyza aliena*, Broken Hill [western New South Wales], 9.vi.1925, anon. (AM K264571, formerly in SPHTM).

Other material examined (localities only given). Northern Territory: Todd River, 9 km NE of Alice Springs (ANIC). Queensland: Eidsvold (ANIC). New South Wales: many specimens seen from many localities (not listed here), ranging from coast to far west of state and including higher ranges, mostly S of 32°S (AM, ANIC). Australian Capital Territory: numerous localities in Canberra district (ANIC). Victoria: Delegate River (AM); Benalla (AM); La Trobe University (AM, MV). Tasmania: Miena (ANIC); Lake Saint Clair (AM). South Australia: Mount Gambier (ANIC); Waite Park (ANIC); Mount Lofty (SAM); Ravine des Casoars, Kangaroo Island (AM); Stockport (ANIC); Maree (ANIC); Old Alton Downs, Simpson Desert (ANIC). Western Australia: Thomas River estuary, Esperance district (ANIC); Meerup Springs Farm, near Northcliffe (AM); near Mount Chudalup (AM); Frankland River (AM); Margaret River (AM).

Distribution. Temperate Australia generally, approaching the tropics in Queensland and Northern Territory (near Alice Springs), south to Victoria, Tasmania, and southern coast of Western Australia; including some high-rainfall and arid areas, sea-level to moderate altitudes.

Notes

Helosciomyza fuscinevris is the only Australian species of the genus with pteropleural (anepimeral) setulae. Hypopleural setulae are usually also present, except in a few of the smallest specimens, and abdominal sternite 1 is setulose except in a small number of females, in which this sternite is more reduced than in males.

According to Barnes (1981) this species is extremely similar to *H. subalpina* Tonnoir & Malloch, the only New Zealand species now retained in *Helosciomyza*. Barnes seems to infer that the c. 80 specimens of *H. subalpina* which he examined lack setulae on the ventral surface of vein 1 (or R1). I have carefully examined 41 Australian specimens of *H. fuscinevris*, of which 40 possess one or more minute ventral setulae on vein 1. Also the dorsal striping of the thorax is less distinct in *H. subalpina*. These data seem to indicate a significant genetic difference between New Zealand and Australian populations, but this needs confirmation by more detailed morphological and molecular studies.

The surstyli are slightly variable in shape, but in most specimens form an asymmetrical pair (Figs 16, 17); the cuticle on much of the posterior surface is thinner than elsewhere, almost membranous; pruinescence may be apparently absent or is present on part of the basal third.

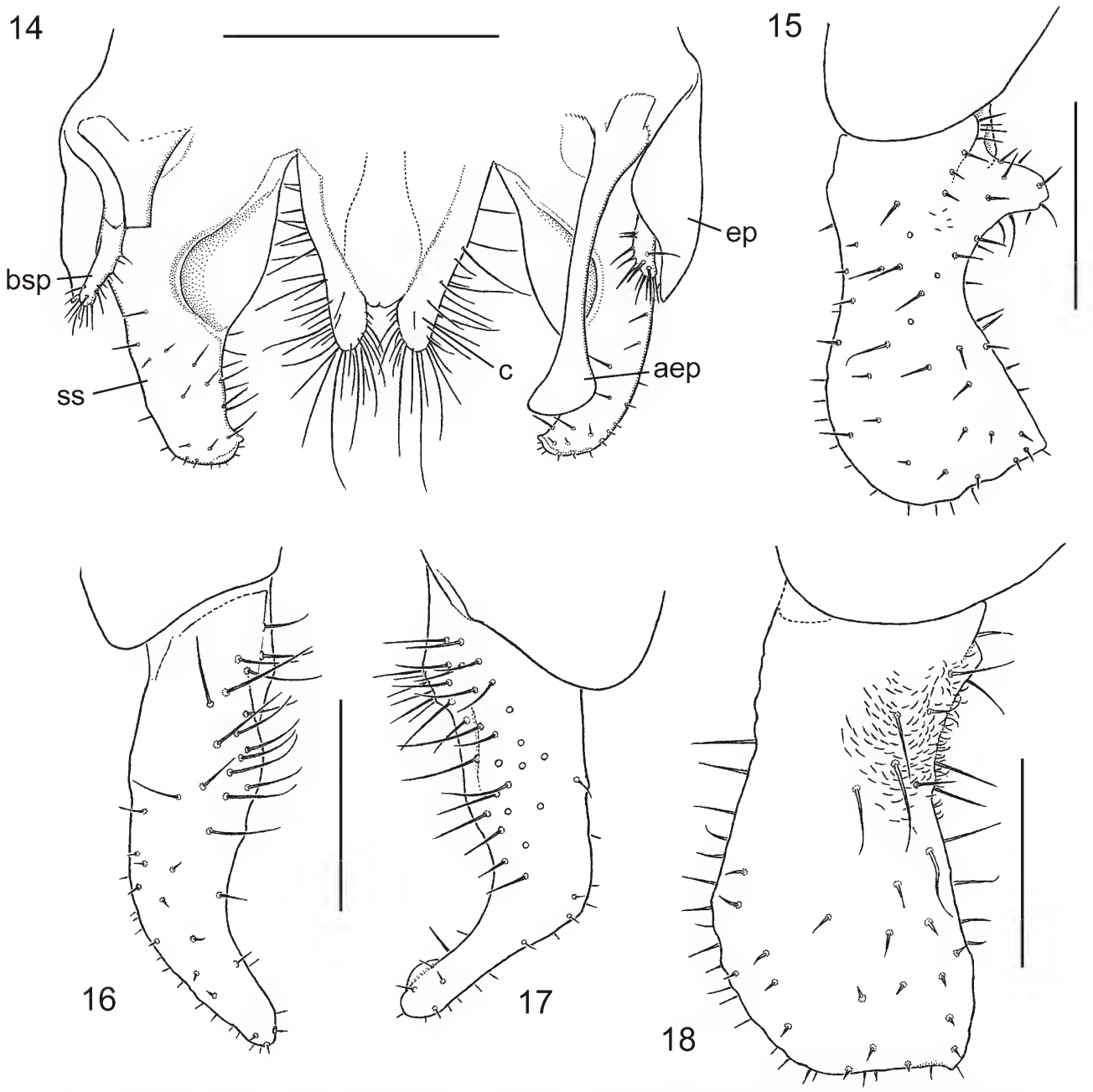
Helosciomyza bickeli n.sp.

Figs 2, 15

Helosciomyza ferruginea Hendel.–Steyskal & Knutson, 1979:734–736 (misidentifications; fig. 16 probably refers to *H. steyskali*, fig. 18 refers to *H. bickeli*); Barnes, 1981: 56–57 (in part, misidentification; fig. 13 does not represent *H. bickeli*).

Type material. Holotype ♂. New South Wales: "Mooraback", Werrikimbe National Park, 31°09'S 152°13'E, 980 m, 6.xii.1986, D.J.B. (AM K264288). Double-mounted on micro-pin through polyporus, postabdomen in micro-vial on pin. Paratypes. New South Wales: 1♂, Gibraltar Range National Park, Feb. 1982, B.J.D. (AM); 9♂♂, Mount Banda Banda, 1200 m, Dec. 1986, D.J.B. (AM, ANIC); 1♂, 2♀♀, Cobcroft Creek, Werrikimbe, Dec. 1986, D.J.B. (AM).

Other material examined (localities only given). Queensland: 7 miles (c. 11 km) up Mount Lewis Road, Julatten district (ANIC); Mount Edith, N of Tinaroo Dam (ANIC); Sluice Creek, near Millaa Millaa (ANIC); Paluma (AM); Eurimbula, Miriam Vale district (AM, QM); Summer Creek, near Kenilworth (AM); Mount Tenison Woods, near Mount Glorious (AM); Bundaroo Creek, Conondale Range (AM); Killarney (UQIC); Binna Burra, Lamington National Park (AM). New South Wales: Mount Warning, near Murwillumbah (AM); Falbrook, 30 km NNE of Singleton (AM); Barrington River, W of Gloucester (ANIC); Wallaroo State Forest, N of Raymond Terrace (ANIC); Myall Lakes (AM); Myall River (AM); Mount



Figures 14–18. *(14) Neosciomyza peckorum* (Boyd River), terminal part of epandrium and associated structures, anterior view, right anterior epandrial process cut away for clarity, scale = 0.5 mm. *(15) Helosciomyza bickeli* (Cobcroft Creek), left surstylus, outer view, scale = 0.2 mm. *(16) H. fuscinevris* (Clarence, near Lithgow), left surstylus, outer view. *(17)* same specimen, right surstylus, outer view. *(18) H. subacuta* (Wannon River), left surstylus, outer view. Figs 15–18 all same scale. *aep*, anterior epandrial process; *bsp*, basal surstylar process; *c*, cercus; *ep*, epandrium; *ss*, surstylus.

Wilson (AM); 8 km S of Mount Wilson (AM); Roberts Creek, near East Kurrajong (AM); Narrabeen, near Sydney (AM); Willoughby, near Sydney (AM); Oxford Falls, near Sydney (AM, ANIC); Sydney (AM); Royal National Park (AM); Otford (AM). Tasmania: Frodshams Pass, near Mount Wedge (AM).

Description (male, female). Medium-sized brownish-variegated fly of medium build, with almost unmarked wing; most parts pruinescent and non-shining.

Coloration (dry, clean, non-greasy specimens). Head rufous to pale tawny dorsally with pale grey pruinescence on median zone enclosing postvertical and ocellar bristles and extending narrowly well in front of anterior ocellus and usually more than half distance from ocellus to ptilinal suture; fronto-orbital plates greyish pruinescent; fronto-orbital margins narrowly more silvery pruinescent; upper occiput extensively grey-pruinescent, usually with tawny spot between each outer vertical bristle and eye margin; face and cheeks pale tawny-yellow with whitish pruinescence. Antenna largely tawny; segment 3 tawny-orange with at most very faint brown suffusion not forming distinct dorsal or distal zone; arista largely brown, tawny at extreme base. Prelabrum and palpus tawny-yellow, latter with black setulae and bristles. Mesoscutum orange-tawny, with broadly creamy-grey lateral margins and five additional pale grey longitudinal stripes—median and paired dorsocentral and sublateral; sublateral stripe narrow, not extending in front of suture and usually

connected to dorsocentral stripe anteriorly and posteriorly; scutellum orange-tawny with pale pruinescent zone on each side dorsally and usually pale pruinescent anterior margin; humeral callus whitish-pruinescent dorsally, tawny ventrally; pleura extensively whitish-pruinescent; upper proepimeron (behind spiracle) tawny, the tawny zone extending broadly and obliquely across upper mesopleuron to membranous cleft, but leaving small posterodorsal whitish zone on mesopleuron; remainder of pleura largely orange-tawny with whitish pruinescence, changing in appearance with angle of view. Legs mainly orange-tawny; fore femur with subapical brown mark, often more distinct on anterior than on posterior surface, with no brown zone on basal half; other femora with more distinct subapical brown to blackish mark; tibiae usually with brown to blackish distal zone, usually least developed on mid tibia; hind tibia usually with sub-basal brown zone, sometimes indistinguishable; fore and hind tarsi with segments 4 and 5 brown, segment 3 usually partly brown; mid tarsus with at least segment 5 brown. Wing: largely hyaline, with diffuse brown spot in subcostal cell, small brown spot on anterior crossvein, and indistinct brownish suffusion on discal crossvein. Halter pale yellow. Abdomen tawny-brown to yellowish, not showing consistent pattern in dried specimens; all tergites thinly pruinescent, tergite 5 not less so than preceding tergites.

Head slightly higher than long; cheek c. 0.29–0.34 as high as eye, with scattered small setulae often tending to form a single peristomial series anteriorly; face with rather narrow, rounded median carina; the following bristles present: inner and outer vertical, long subparallel to slightly convergent postverticals, ocellar, two fronto-orbitals, anterior one shorter, usually three postgenals, posterior one situated higher than anterior one. Antenna: segment 6 pubescent on whole length, with many hairs almost as long as its basal diameter. Palpus moderately large, setulose, with some distal setulae enlarged or thickened.

Thorax. Mesoscutum with many non-seriate setulae, generally distributed except towards lateral margins; humeral callus with few setulae; scutellum approximately flat dorsally, without setulae; mesopleuron bare; sternopleuron ventrally in male with many long coarse setulae, in female these much less developed, leaving irregularly transverse series of major bristles well differentiated in front of coxae; pteropleuron (anepimeron) without setulae; hypopleuron (metepisternum) with minute downwardly directed setulae, varying in precise distribution and in number (two to twelve in examined specimens); the following, mostly large, thoracic bristles present: two dorsocentrals, prescutellar acrostichal, presutural, intra-alar, postalar, humeral, 1 + 1 notopleurals, proepisternal (propleural), small proepimeral (stigmatal), two upper sternopleurals. Fore femur with a series of large dorsal bristles, and on distal half, with posteroventral bristles better developed in female than in male, often with many fine almost erect ventral setulae, often including mollisetae, in male, these setulae fewer and shorter in female; mid femur with irregularly placed group of enlarged anterior setulae just beyond mid-length, one large posterior preapical bristle and, in male only, a comb-like series of posteroventral setulae just before apex; hind femur with one or two anterodorsal bristles near distal quarter, in male with many fine erect ventral setulae, in female these shorter and fewer; fore tibia with one preapical dorsal bristle; mid tibia with one preapical dorsal bristle and c. five terminal spurs of various sizes; hind tibia with long typical preapical dorsal bristle, one equally stout anterodorsal bristle between this and apex, and two apical ventral spurs of different sizes; hind basitarsus shorter and broader in male than in female, with many setulae, but lacking basal ventral cluster of short back setulae as seen in *H. australica*; fore and hind tarsal segments 2, 3 and 4 of male with median ventral scopulae (pads of very fine, dense pubescence), these undeveloped in female; segment 4 of each tarsus in male very short and relatively broad, almost crescentic, in female little longer, subtriangular. Wing: costa with large, well spaced anterior spines (*sensu* Hackman & Väisänen, 1985), progressively smaller distally, bordering second costal, subcostal, and marginal cells; separate series of anterodorsal spaced spines absent; vein 1 consistently without setulae on ventral surface; distal section of vein 6 extending to margin, thick and well sclerotized on c. basal quarter of length, abruptly narrowed and weakened beyond.

Abdomen. Pleural membrane without setulae in region of spiracle 1; sternite 1 somewhat sclerotized, divided medially, setulose, better developed in male than in female; sternite 5 of male with compact zone of dense short, rather stout setulae on each side of bare median zone, setulae elsewhere on sternite 5 sparse and longer; sternite 5 of female without such differentiated zones, with scattered setulae slightly larger laterally than centrally. Male postabdomen: posterior margin of epandrium almost straight in profile, bordered by elongate basal plate of surstylus (visible in posterior view), internally without anterior process; surstylus (Fig. 15) slightly broadened basally, with almost transverse basal articular margin and prominent setulose posterior marginal tubercle arising distinctly beyond base, main distal part almost hatchet-blade shaped, rather narrowed before distal expansion, which is broadly rounded anteriorly, subacutely angular postero-apically, with narrowly inflexed distal margin, patch of microtrichia on outer surface (present in *H. steyskali*, *H. subacuta* and related species) virtually absent; basal surstylar process absent; aedeagus complex, with elongate obtuse epiphallus (spinus); aedeagal apodeme large, deep, bilaterally compressed; cerci elongate ovate, leaf-like, joined by membrane for c. half length of each. Female abdomen: spiracles 1 to 7 located in pleural membrane and distinctly removed from margins of tergites; tergite 5 and sternite 5 large and unmodified; postabdomen simple. not very extensile; tergite 6 and sternite 6 smaller than preceding sclerites; segment 7 narrower, with sternite divided longitudinally into two setulose plates; tergite 8 forming compact sclerite; sternite 8 elongate, setulose; apparent tergite 9 and sternite 9 small but distinct, setulose; cerci separate, subcylindrical with some apical setulae long and fine; spermathecae three, subspherical, with black cuticular lining, two of them attached to end of a common duct.

Dimensions. Total length, ♂ 5.4–5.9 mm, ♀ 6.4–6.5 mm; length of thorax, ♂ 2.6–3.0 mm, ♀ 3.1–3.2 mm; length of wing, ♂ 5.5–6.0 mm, ♀ 6.2–6.3 mm.

Distribution. Queensland: east coast and nearby ranges as far north as Julatten district. New South Wales: coast and nearby ranges. Tasmania: mountainous areas of south—single record. This is the only helosciomyzid species known from the Australian tropics.

Notes

Helosciomyza bickeli and *H. fuscinevris* are the only Australian helosciomyzids with a setulose sternite 1. They also share the presence of minute hypopleural setulae. *Helosciomyza bickeli* differs from *H. fuscinevris* in the

absence of a brown zone on antennal segment 3, the absence of pteropleural setulae, and the differently shaped surstylus. The shape of the surstylus of *H. bickeli* somewhat resembles that of *H. steyskali* (compare Figs 15, 23), but is narrower than in that species, with much less pubescence on the outer surface. *Helosciomyza steyskali* further differs from *H. bickeli* in the absence of setulae on the hypopleuron and on the more reduced sternite 1, also the extensive brown zone on the anterior surface of the fore femur, which extends on to the basal third. The status of the little known Tasmanian population needs further investigation in view of its wide isolation from northern populations.

The specific epithet refers to Daniel J. Bickel, who collected significant material and has supported this study.

Helosciomyza subacuta n.sp.

Fig. 18

Type material. Holotype ♂. Victoria: Wannon River, near Jimmy's [Jimmy] Creek, Grampians, 10.xii.1977, D.K.M., M.A.S. (MV). Double-mounted on micro-pin through polyporus, postabdomen in micro-vial on pin. Paratypes. Victoria: 4♂♂, 1♀ same data as holotype (AM); 1♂, Reedy Creek, 5 km E of Cann River, June 1989, D.K.M. (AM).

Other material (doubtfully determined specimens). New South Wales: 1♂, Kunama [near Batlow], Aug. 1961, D.H.C. (ANIC); 1♀, Boyd River crossing, Kanangra-Boyd National Park, April 2002, B.J.D., D.K.M. (AM).

Description (male, female). Somewhat resembling *H. bickeli*, *H. steyskali* etc.; agreeing with description of first species, except as indicated.

Coloration. Antennal segment 3 orange-tawny with rather extensive dorsal tawny-brown zone distad from about vicinity of aristal insertion to apex, not forming a sharply defined zone on medial surface. Mesopleuron with orange-tawny zone usually diffuse and indistinct. Fore femur, on posterior surface, tawny-yellow, with whitish pruinescence and generally no darker zones, except sometimes for a relatively small subapical grey-brown spot, on anterior surface with the usual distal brown zone but no basal or sub-basal brown zone; fore tarsus with segment 3 suffused with brown except at base; hind tibia with basal to sub-basal brownish zone. Wing: brown spot in subcostal cell absent or represented by slight yellow-brown suffusion; mark on anterior crossvein slight, that on discal crossvein obsolete.

Head. Height of cheek 0.36–0.39 of height of eye; scattered small setulae of cheek region usually not uniseriate anteriorly; face in profile usually less receding below than in related species.

Thorax. Pteropleuron and hypopleuron without setulae; proepimeral bristle absent or small.

Abdomen. Sternite 1 vestigial, without setulae. Male postabdomen: surstylus without posterior sub-basal tubercle or process, but shortly explanate on extreme base of posterior surface, with basal articular margin almost transverse in lateral view, with general outline slightly expanded distally or almost parallel-sided, postero-apically with short but acute prominence, distal margin in front of prominence narrowly inflexed.

Dimensions. Total length, ♂ 5.9–6.0 mm, ♀ 6.3 mm; length of thorax, ♂ 3.0–3.3 mm, ♀ 3.2 mm; length of wing, ♂ 6.5–7.0 mm, ♀ 6.8 mm.

Distribution. Victoria: lowlands or near-lowlands in both east and west of state. New South Wales: only doubtfully determined specimens from central and southern highlands (see note below).

Notes

Together with *Helosciomyza steyskali*, typical populations of *H. subacuta* are distinguished from other species of the *fuscinevris* group by having the pteropleuron and abdominal sternite 1 without setulae, the infuscation on antennal segment 3 not very intense and more or less restricted to the dorsal half, and, apparently, no hypopleural setulae. The fore femur lacks any brown zone on the basal half, in contrast to *H. steyskali*, *H. obliqua*, and *H. macalpinei*. The shape of the surstylus is distinctive (Fig. 18), as it is somewhat elongate, lacks a sub-basal posterior process, but has an acute, slightly distally inclined posterodistal angle. Segment 3 of the fore tarsus is less strongly browned distally than in *H. steyskali*, but, as the pigment fades slightly in old specimens, this character must be interpreted with care and the placement of females is difficult.

Two specimens listed above from localities in New South Wales are doubtfully referred to *H. subacuta* until their respective local populations are better known. The male from Kunama generally resembles specimens from Victoria but has hypopleural setulae, a condition otherwise only known for Australian *Helosciomyza* species in *H. fuscinevris* and *H. bickeli*, but this Kunama specimen lacks the setulae on sternite 1, normally present in those species; its surstylus is typical of *H. subacuta* in shape, but has setulae on the very slightly prominent posterobasal tubercle. The specimen from Boyd River is typical of *H. subacuta* in all features known for the female, but it is desirable that local males be examined for more decisive identification of the population.

The specific epithet is a Latin adjective, in reference to the subacute posterodistal angle of the surstylus.

Helosciomyza neboissi n.sp.

Fig. 21

Type material. Holotype ♂. Tasmania: Pelion [probably Pelion Hut vicinity, c. 41°50'S 146°03'E, c. 870 m—E.D.E. pers. comm.], 9.i.1991, I.D.N., E.D.E. (ANIC). Impaled on long pin after preservation in ethanol; genitalia extended and exposed. Paratypes. Tasmania: 1♂, 1♀, same data as holotype (AM, ANIC); 1♂, 1♀, Bluff Hill, 12 km S of Marrakesh, near Arthur River, Nov. 1974, A.N. (MV).

Description (male, female). Resembling *H. bickeli* and especially *H. subacuta*; agreeing with description of former species, except as indicated below.

Coloration (all specimens with pruinescence of head and thorax somewhat discoloured through initial immersion in liquid or retention in a humidified container, but cuticular pigment apparently unfaded). Upper occiput apparently without tawny spot between each outer vertical bristle and eye margin. Antennal segment 3 tawny, with only slightly darker tawny dorsal zone. Mesoscutum without dark cuticular stripes underlying pruinescent longitudinal stripes. Fore femur pale orange-tawny, with dark brown subapical spot on posterior surface narrowly connected dorsally to larger subapical brown mark on anterior surface, but usually without brown zones on basal three-quarters of length; other femora with dark brown apical to subapical zones; tibiae

with brown apical zones, hind tibia with additional sub-basal brown zone; segment 3 of fore tarsus largely brown. Wing with slight brown markings as in *H. bickeli* etc.

Head. Cheek 0.34–0.35 as high as eye.

Thorax. Pteropleuron and hypopleuron without setulae; proepimeral bristle minute or absent. Legs and wing much as in *H. bickeli*.

Abdomen. Sternite 1 almost completely desclerotized, without setulae. Male postabdomen: surstylus approximately transverse at basal articulation, shaped somewhat like that of *H. subacuta* but broader, more broadly truncate apically, with rather large posterobasal setulose tubercle (inconspicuous from some angles), numerous but not dense long setulae or mollisetae near middle of outer surface, and posterior sub-basal patch of microtrichia (Fig. 21). Female: postabdominal sclerites apparently as described for *H. bickeli*.

Dimensions. Total length, ♂ 5.7–7.7 mm, ♀ 7.0–7.7 mm; length of thorax, ♂ 2.6–3.7 mm, ♀ 3.3–3.4 mm; length of wing, ♂ 6.3–7.7 mm, ♀ 7.4 mm.

Distribution. Tasmania: north-western districts, including elevations of c. 870 m or more.

Notes

Helosciomyza neboissi is most similar to *H. subacuta*, which it resembles in the absence of setulae on sternite 1, in coloration of the antenna, and in the usual absence of any brown zone on the anterior surface of the fore femur other than the subapical zone (but one specimen shows some brown suffusion on the more basal part of the anterior surface of both fore femora). It differs from *H. subacuta* in the characters indicated in the key and, in the male, in the broader surstylus with setulose basal tubercle. Also, the two species are perhaps geographically isolated as indicated by presently available data.

The specific epithet refers to Arturs Neboiss, formerly of the Museum of Victoria, who first collected the species, and is remembered for his helpfulness and hospitality.

Helosciomyza australica Steyskal

Figs 20, 22

Helosciomyza australica Steyskal, in Steyskal & Knutson, 1979: 735, figs 14, 15, 25–27, 34–37; Barnes, 1981: 56, figs 11, 12.

Type material (re-examined D.K.M.). Holotype ♂. New South Wales: Picton Lakes [Thirlmere Lakes], "Bred larva", 2.xi.1936, anon. (AM K264619). Cleared abdomen in micro-vial on same pin. Allotype ♀. Similar data to holotype, "#5", 8.xi.1936; puparium (also "#5") in capsule on separate pin (AM). Paratypes. 2♂♂, 3♀♀, similar data to holotype, apparent emergence dates 1.xi.1936 and 2.xi.1936 (AM).

Other material (identification confirmed D.K.M.). New South Wales: Careel Bay, Avalon (*Casuarina* swamp, land now cleared and reclaimed), June 1962, D.K.M. (AM); 1♂, Otford (area now a residential zone), Nov. 1962, D.K.M. (AM).

Female specimens from more southern localities (whence no confirmatory males). New South Wales: Swan Lakes, near Sussex Inlet (AM); Tantawangalo Mountain, near Candelo (AM). Victoria: Mount Donna Buang, near summit, Warburton district (AM). Tasmania: near Russell Falls, Mount Field National Park (AM).

Distribution. New South Wales: lowlands of Sydney district, between c. 33°39'S and 34°14'S. I have seen no specimens from the Sydney district collected after 1962. Possibly also more southern districts of New South Wales, Victoria, and Tasmania.

Notes

The male has the surstylus distinctively shaped and quite without pruinescence in the two specimens viewed under high magnification (Fig. 22), and a distinctive dense, non-linear cluster of short, thick black setulae ventrally at the base of the hind basitarsus, but no such diagnostic structures have been found in the female. Among the species with extensively infuscated antennal segment 3 and no setulae on the hypopleuron and abdominal sternite 1, *H. australica* differs from *H. obliqua* and *H. macalpinei* in having the fore femur entirely tawny-yellow on both anterior and posterior surfaces, except for the subapical brown mark, and fore-tarsal segment 3 is only slightly browned distally. These conditions alone may be inadequate as a reliable diagnostic indicator, especially as only females have been obtained in the apparent southern part of the species' range, and there could be other somewhat similar undocumented species in these areas. These females generally show a slight apical browning of the palpus which may be decurrent along its ventral margin, but the type specimens and the two additional males are apparently too old and faded to show this condition distinctly. In *H. subacuta*, with similarly coloured fore femur to *H. australica*, the palpus is consistently pale yellow to the apex and antenna 3 has relatively little infuscation. The small proepimeral bristle may be present or absent in *H. australica*.

Unfortunately the reared type specimens from Picton Lakes carry no information on larval habitat or habits.

Helosciomyza steyskali n.sp.

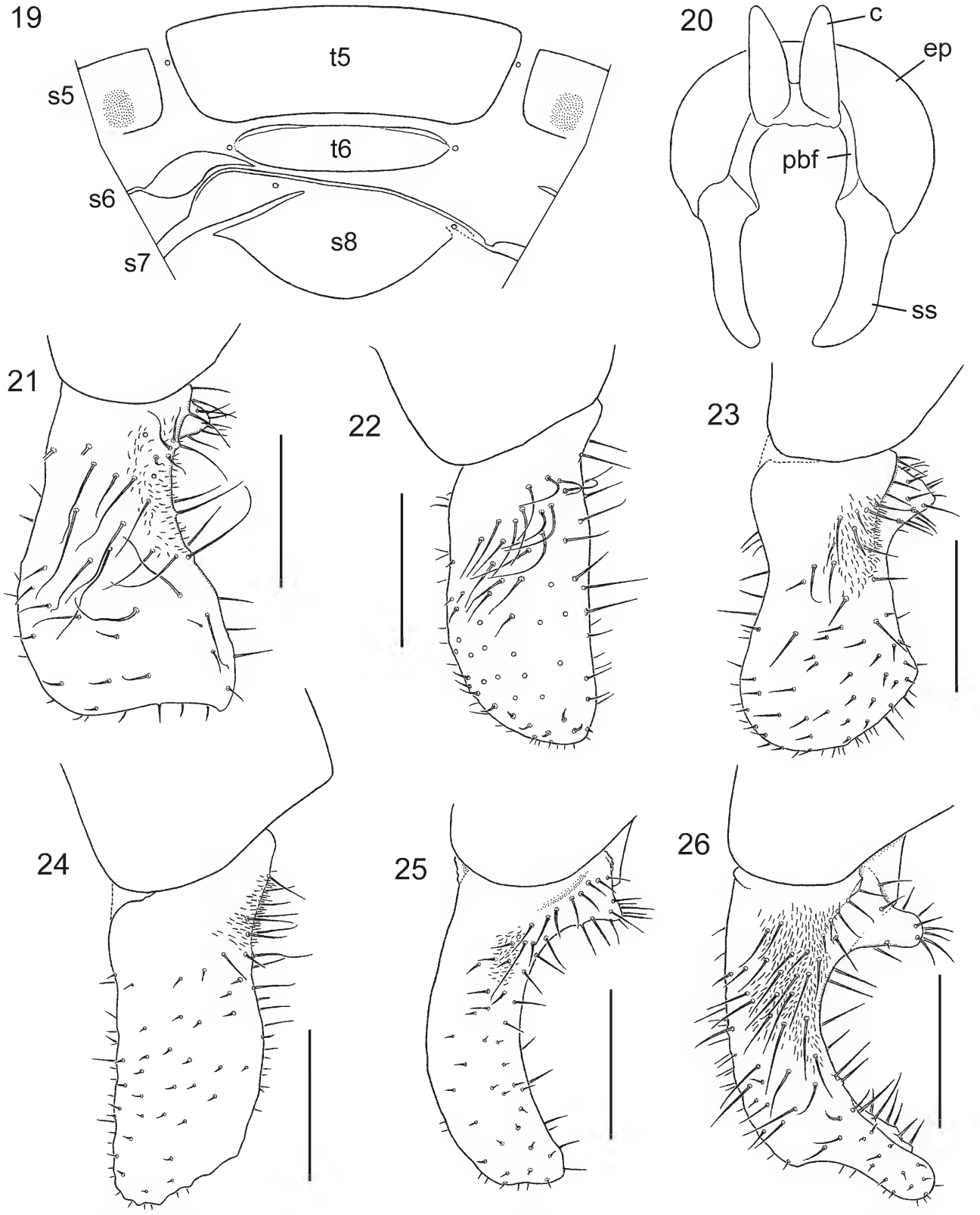
Figs 19, 23

Helosciomyza ferruginea Hendel.–Steyskal & Knutson, 1979: 736 (in part, misidentifications; fig. 16 represents *H. steyskali*, fig. 2 apparently not); Barnes, 1981: 56–57 (in part, misidentifications; figs 13, 14 apply to *H. steyskali*; Queensland record probably applies to *H. bickeli*).

Type material. Holotype ♂. New South Wales: Boyd River [Morong Creek] crossing, Kanangra-Boyd National Park [c. 1200 m], 2–4.iv.2002, B.J.D., D.K.M. (AM K264479). Double-mounted on micro-pin through polyporus, postabdomen in micro-vial on pin. Paratypes. New South Wales: 1♂, same data as holotype (AM); 1♂, same locality, April 2002, B.J.D. (AM); 3♂♂, 1 km N of Boyd River bridge, Kanangra-Boyd National Park, Oct. 2005, D.K.M. (AM). Australian Capital Territory: 1♂, Uriarra State Forest, Oct. 1960, D.H.C. (ANIC); 2♂♂, Blundell's Farm, Jan. 1930, March 1930, L.F.G., I.M.M. (ANIC).

Other material examined (localities only given). New South Wales: Alpine Creek, Snowy Mountains Highway (ANIC). Victoria: 12 km SE of Merrijig, Mansfield district (MV); Mount Donna Buang, near summit (AM); Mulgrave, near Melbourne (MV); Cape Otway (MV). Tasmania: Flowerdale River, near Meunna (MV); Hellyer Gorge, Waratah Highway (AM); Lyell Highway, near Clarence River (ANIC); Mount Field National Park (AM).

Because certainty of identification is difficult for females, only males are included in the type series.



Figures 19–26. *(19) Helosciomyza steyskali*, protandrogram. *(20) H. australica*, epandrium and associated structures, posterior view, semi diagrammatic, setulae omitted. *(21) H. neboissi* (Pelion), left surstylus, outer view, scale = 0.2 mm. *(22). H. australica* (Picton Lakes), left surstylus, outer view. *(23). H. steyskali* (Boyd River), left surstylus, outer view. *(24). H. obliqua* (Mount Donna Buang), left surstylus, outer view. *(25). H. driesseni* (holotype), left surstylus, outer view. *(26). H. macalpinei* (holotype), left surstylus, outer view. Figs 21–26 all to same scale. *c*, cercus; *ep*, epandrium; *pbf*, posterobasal foot of surstylus; *ss*, surstylus; *s5–s8*, sternites 5 to 8; *t5*, *t6*, tergites 5 and 6.

Description (male). Resembling *H. bickeli* in most characters except as indicated below. Females may agree in general characters, which may not be absolutely diagnostic.

Coloration. Antennal segment 3 orange-tawny, with small, diffuse brown dorsal zone not extending to apex, more developed than in *H. bickeli*, less so than in *H. obliqua* and *H. macalpinei*. Fore femur with largely tawny-orange ground colour, its anterior surface with large dark brown apical zone and broad brown sub-basal zone usually incompletely separated from apical zone, posterior surface with variable coverage of grey pruinescence and usually only indistinct brownish apical spot; fore tarsus with segment 3 dark brown on at least distal half, segments 4 and 5 entirely dark brown; hind tibia with sub-basal slightly diffuse brown zone.

Head. Height of cheek c. 0.26–0.35 of height of eye.

Thorax. Pteropleuron and hypopleuron without setulae. Wing essentially as described for *H. bickeli*.

Abdomen. Pleural membrane without setulae in region of spiracle 1; sternite 1 vestigial, without setulae; sternite 5 resembling that of *H. bickeli*; surstylus shaped somewhat as in *H. bickeli*, but broader, less strongly narrowed near mid-length, more rounded distally, with similar sub-basal posterior marginal tubercle more deeply inset from outer surface of surstylus.

Dimensions. Total length 4.8–5.9 mm; length of thorax 2.3–3.2 mm; length of wing, 5.0–6.9 mm.

Distribution. New South Wales: highlands from Boyd Plateau southwards. Australian Capital Territory: Canberra district. Victoria: perhaps widely distributed (few records). Tasmania: apparently widely distributed.

Notes

Helosciomyza steyskali is one of those species of the *fuscinevris* group having no setulae on the pteropleuron, hypopleuron, and abdominal sternite 1. Within this category, it differs rather markedly from *H. obliqua*, *H. macalpinei* and *H. australica* in the only slightly developed dark zone on antennal segment 3, but is less clearly differentiated from *H. subacuta*. *Helosciomyza steyskali* can usually be distinguished from *H. subacuta* by the broad brown sub-basal zone on the anterior surface of the fore femur, but the sharpest difference is in the shape of the surstylus of the male (Fig. 23). *Helosciomyza steyskali* differs from *H. bickeli* (with which it has been confused under the erroneous name *H. ferruginea*) in the absence of setulae on the hypopleuron and sternite 1, in the broad brown anterior zone extending near the base on the fore femur, and in the broader surstylus with an extensive tract of microtrichia.

Three of the paratypes from Boyd River vicinity are labelled "Nr dead chook" (i.e. domestic fowl).

The specific epithet refers to George C. Steyskal, who first accurately characterized and delimited the helosciomyzids (at subfamily level, 1965) and made the first review of the Australian species (1979, with L. Knutson).

Helosciomyza obliqua n.sp.

Fig. 24

Type material. Holotype ♂. New South Wales: Boyd River [Morong Creek] crossing, Kanangra-Boyd National Park, 2–4.iv.2002, B.J.D., D.K.M. (AM K263399); mounted on micro-pin through polyporus, postabdomen in micro-vial on main pin. Paratypes. New South Wales: 1♀, same data as holotype (AM); 1♂, Wright's Lookout, New England National Park, March 1961, D.K.M. (AM); 1♂, Wentworth Falls, Blue Mountains, Jan. 1963, D.K.M. (AM, erroneously determined as paratype of *H. macalpinei* by G. Steyskal). Victoria: 2♂♂, Mount Donna Buang, near summit, Warburton district, April 2003, B.J.D., D.K.M. (AM, MV).

Description (male, female). Resembling *H. macalpinei* and *H. bickeli*, agreeing with description of latter except as indicated below.

Coloration. Antennal segment 3 in large part dark brown to blackish (unfaded specimens), on outer lateral surface with ventrobasal tawny-orange zone, on medial surface with tawny-orange zone restricted to c. basal third. Mesopleuron with tawny-orange mark of very variable extent. Fore femur on anterior surface with extensive sub-basal brown zone, distally narrowly or incompletely separated from apical brown zone, on posterior surface largely mid-grey (colour resulting from pale grey pruinescence over darker brown cuticle), darker just before apex, or with posterior surface paler yellow grey with darker subapical zone, or, in one specimen with nebulous mid grey zone on basal half separated from distal grey zone by yellow-grey zone, approximately as in typical specimens of *H. macalpinei*; fore tarsus with segment 3 dark brown on distal part.

Head. Cheek c. 0.28–0.37 as high as eye.

Thorax. Hypopleuron without setulae; proepimeral bristle present, minute, in all available males. Mid femur with comb of posteroventral setulae weakly developed; hind basitarsus lacking basal ventral cluster of short black setulae.

Abdomen. Sternite 1 much reduced, without setulae; sternite 5 of male with paired zones of dense, thick setulae broader than in *H. bickeli* and *H. macalpinei*, often more or less meeting on median line. Male postabdomen: epandrium with posterior margin broadly subangularly prominent above and behind articulation with surstylus; surstylus (Fig. 24) with oblique basal articular margin, without sub-basal posterior process and noticeable excision of inner basal margin, almost parallel-sided beyond base, distal margin indistinctly toothed, oblique so as to be more prominent (though rounded) anterodistally (in contrast to *H. subacuta*), not or very obtusely angular posterodistally.

Dimensions. Total length, ♂—no available measurement (all males having abdomen dissected), ♀ 5.1 mm; length of thorax, ♂ 2.2–3.0 mm, ♀ 2.7 mm; length of wing, ♂ 5.4–6.6 mm, ♀ 5.8 mm.

Distribution. New South Wales and Victoria: cooler areas from New England National Park to Warburton district. Records few and scattered.

Notes

Among the species of the *fuscinevris* group with extensively darkened antennal segment 3, males of *H. obliqua* are most readily distinguished by the shape of the epandrium and surstylus (see details above and Fig. 24). Also *H. obliqua* generally has a proepimeral bristle or setula (often minute), which is usually absent in *H. macalpinei* but may be present or absent in *H. australica*. Coloration of the posterior surface of the fore femur is variable in *H. obliqua*, but the separate distinct posterodorsal dark grey mark generally present in *H. macalpinei* is usually less distinct or absent in *H. obliqua*; on the often concealed anterior surface the extensive brown

zone, extending near the base, contrasts particularly with the condition in *H. australica*, less so with that in *H. macalpinei*. Separation of the females of *H. obliqua* from those of related species is often a matter of uncertainty.

The specific epithet is a Latin adjective meaning oblique, in reference to the outline of the surstylus.

Helosciomyza driesseni n.sp.

Figs 25, 27

Type material. Holotype ♂. Tasmania: Flood Creek, near Lake Saint Clair, 42.102°S 146.113°E, button grass moorland, 16–17.ii.2004, M.M.D. (AM K264371). Double-mounted on micro-pin through polyporus after preservation in ethanol, postabdomen in micro-vial on pin. Paratypes. Tasmania: 2♂♂, 2♀♀, same data as holotype (AM, ANIC); 2♀♀, Rufus Canal Road East, 42.10°S 146.75–146.86°E, Feb. 2004, M.M.D. (AM); 1♀, "Bedlam", 42.73°S 146.10°E, Feb. 2004, M.M.D. (AM); 2♂♂, Dove Lake, Cradle Mountain National Park, Dec. 2003, S.A.M. (AM, TDPI).

Description (male, female). Resembling other species of the *fuscinevris* group in most characters; agreeing approximately with description of *H. bickeli* except as indicated below, but because most specimens have been immersed in ethanol for five years before drying and mounting, some details of coloration are imperfectly preserved.

Coloration. Occipital region with broad dark cuticular mark of characteristic shape (Fig. 27). Antennal segment 3 with large brown zone between aristal insertion and apex, tawny-orange basally and ventrally. Palpus tawny-yellow, sometimes faintly browned apically. Fore femur tawny-orange, on anterior surface with broad brown zone extending from near apex almost to base, on posterior surface with posterodorsal dark grey-pruinescent diffuse zone of variable length, usually becoming narrower and more distally restricted or fading distally, but without separate dark brownish subapical mark centred on posterior surface as in *H. macalpinei*.

Head. Cheek c. 0.39 as high as eye.

Thorax. Pteropleuron and hypopleuron without setulae; proepimeral bristle minute or absent. Fore tarsal segment 4 often shorter and broader than in corresponding sex of *H. macalpinei*.

Abdomen. Sternite 1 vestigial, without setulae. Male postabdomen: surstylus (Fig. 25) relatively slender, curved, not distally broadened, with large, setulose posterobasal tubercle and moderately developed setulae posteriorly and on medial surface.

Dimensions (most specimens not accurately measurable). Total length, ♂ 5.2 mm, ♀ 5.7 mm; length of thorax, ♂ 2.6 mm, ♀ 2.6 mm; length of wing, ♂ 6.2 mm, ♀ 6.4 mm.

Distribution. Tasmania: northern to south-central highlands.

Notes

Helosciomyza driesseni, together with *H. macalpinei* and *H. obliqua*, belongs with those species of the *fuscinevris* group having no pteropleural setulae, antenna 3 strongly infuscated in part, and the fore femur with brown zone on anterior surface extending near base. *Helosciomyza driesseni* differs from related species in having a broad dark mark of characteristic shape just above the occipital foramen (Fig. 27). This mark is due to dark cuticular pigment and, though partly obscured by pale pruinescence, is demonstrably present in nine of the ten available specimens of *H. driesseni*. Other species of the *fuscinevris* group have at most a more restricted dark zone, more or less surrounding the supracervical setulae. In the male of *H. driesseni* the form of the surstylus is distinct from that of *H. obliqua* and *H. macalpinei* (compare Fig. 25 with Figs 24, 26). The two latter species are only known from mainland Australia, whereas *H. driesseni* is from the Tasmanian highlands, but it is possible that the distributions are incompletely known.

Michael Driessen indicates that his material of *H. driesseni* was collected by sweeping vegetation on button grass moorland. This is a low vegetation community dominated by the sedge *Gymnoschoenus sphaerocephalus*, and is characteristic of certain parts of the Tasmanian highlands.

The specific epithet refers to Michael M. Driessen, who collected type material.

Helosciomyza macalpinei Steyskal

Figs 6, 7, 26

Helosciomyza macalpinei Steyskal, in Steyskal & Knutson, 1979: 737–738, fig. 23, ?fig. 24; Barnes, 1981: 57, figs 15, 16.

Type material (re-examined D.K.M.). Holotype ♂. New South Wales: Clyde Mountain, near Braidwood, 2400 ft. [c. 730 m], 25.ii.1961, D.K.M. (AM K264247). Allotype ♀. Same data as holotype (AM). Paratypes. 3♂♂, 2♀♀, same data as holotype.

The above specimens have been correctly determined and listed by Steyskal (1979: 738). Otherwise the published list is unreliable, as some given localities do not apply to *H. macalpinei* (e.g., Careel Bay and Otford), and specimens from Mount Wilson, appropriately labelled by Steyskal as paratypes of *H. macalpinei*, are not mentioned.

Other material (all checked by D.K.M.; localities only given). New South Wales: Wright's Lookout, New England National Park (AM); Mount Wilson (AM); below Govett's Leap, near Blackheath (AM); Katoomba (AM); Wentworth Falls (AM); Deep Creek, near Narrabeen (ANIC); Rutherford Creek, Brown Mountain, Nimmitabel district (ANIC).

Distribution. New South Wales: mainly cool, mountainous localities in north and south; single authentic record for coastal lowlands (Deep Creek).

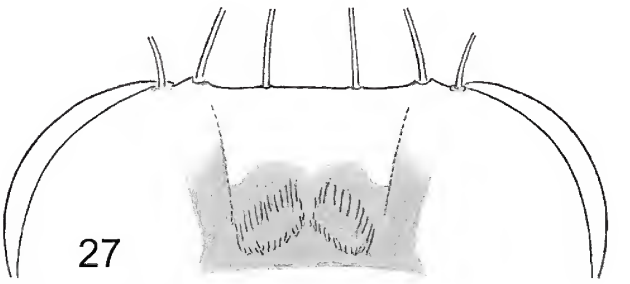


Figure 27. *Helosciomyza driesseni*, upper part of occiput, showing characteristic dark mark, most setulae omitted.

Notes

Males of *H. macalpinei* are distinguishable from those of other species of the *fuscinevris* group with largely infuscated antennal segment 3 and no hypopleural setulae by the shape of the surstylus (Fig. 26). Usually the proepimeral bristle is absent, but in the holotype of *H. macalpinei* a very small such bristle is present on the left side only. Usually the fore femur has an elongate dark grey posterodorsal mark before mid-length which is well separated from the subapical posterior dark mark, and the often concealed anterior surface has a broad brown basal zone, which is generally separate from the brown distal zone. *Helosciomyza australica* appears to be consistently without any brown zone on the basal half of the fore femur. Coloration of the fore femur in *H. obliqua* is variable; some specimens approach the condition seen in *H. macalpinei*, but the two dark marks on the fore femur, as seen in posterior view, are generally less strongly differentiated, and a small proepisternal bristle is generally present, at least in the limited available material. However, certain identification of some female specimens is not achievable.

Genus *Neosciomyza* Barnes

Neosciomyza Barnes, 1981: 61. Type species (original designation): *Helosciomyza anhecta* Steyskal.

Notes

This genus is distinguished as indicated in the key to genera. Reasons are given under the genus *Luta* for the exclusion of *L. luteipennis* from *Neosciomyza*.

Neosciomyza anhecta (Steyskal)

Helosciomyza anhecta Steyskal, in Steyskal & Knutson, 1979: 733–734, fig. 13.

Neosciomyza anhecta (Steyskal).–Barnes, 1981: 61, figs 28, 29.

Type material (re-examined D.K.M.). Holotype ♂. Tasmania: Mount Barrow, 3000 ft. [c. 1040 m, Launceston district] 25.i.1960, D.K.M. (AM K264502). Glued to card point. Paratype. Tasmania: 1♂, 16 mi. [c. 26 km] NE of Cradle Mountain, 5.i.1960, D.K.M. (AM). On card point, now much damaged, postabdomen in micro-vial on pin.

Dimensions of holotype. Total length 5.8 mm; length of thorax 2.8 mm; length of wing 7.3 mm.

Distribution. Tasmania: northern districts.

Notes

Neosciomyza anhecta is very similar to *N. peckorum* and is distinguished as indicated under that species. I have seen no specimens additional to the type specimens collected in 1960.

Neosciomyza peckorum n.sp.

Figs 1, 8–10, 14, 28

Type material. Holotype ♂. Australian Capital Territory: Picadilly Circus [road junction], Brindabella Range, c. 800 m, 29.iv.1972, D.K.M., K.T.R. (AM K264387). Double-mounted on micro-pin through polyporus. Paratypes. Australian Capital Territory: 1♂, Picadilly Circus, April 1978, S.B.P., J.K.-P. (ANIC); 1♀, Black Mountain, Canberra, July 1960, I.F.C. (ANIC). New South Wales: 1♂, Kanangra-Boyd National Park, 1 km N of Boyd River bridge, c. 1200 m, Oct. 2005, D.K.M. (AM).

Other material examined. Victoria: 3♂♂, Acheron Gap, near Warburton, 750 m, April 1978, S.B.P., J.K.-P. (ANIC).

Description (male, female). Rather large, slightly elongate, predominantly dull tawny fly, with almost unmarked wing; most parts pruinescent and non-shining.

Coloration (clean specimens which have not passed through alcohol). Head, in large part, tawny-orange; postfrons with darker tawny-brown ocellar region, largely covered with greyish pruinescence, and paler grey to yellowish-pruinescent orbital margin; face and cheeks paler than rest of head, yellowish with whitish pruinescence. Antenna largely dark brown; more basal parts of segment 3 tawny. Prelabrum yellow to grey-brown; palpus tawny-yellow basally, grey-brown on distal third or more. Thorax dorsally tawny-orange; mesoscutum broadly creamy grey-pruinescent on lateral margins, with narrower pale-pruinescent dorsocentral stripe interrupted at suture and between the two dorsocentral bristles, and very narrow less distinct median pale-pruinescent stripe; humeral callus pale-pruinescent, except on ventral margin near spiracle; scutellum without pale-pruinescent margins; pleura tawny-orange, very generally covered with dense pale greyish to yellowish pruinescence, mesopleuron thus without any exposed tawny areas. Legs largely pale tawny-orange; all femora broadly brown-black at apices; tibiae all brown-black apically, mid and hind tibiae also with brown basal zone; tarsal segment 3 partly brown, segments 4 and 5 usually darker brown. Wing: membrane slightly tinged with yellow-brown, less intensely so than in *Luta luteipennis*; subcostal cell with broad yellow-brown blotch restricted to part of cell near end of subcosta; veins tawny; anterior and discal crossveins without trace of darker pigmentation. Halter yellow. Abdomen tawny, without distinct darker markings; tergites 1 to 4 covered with fine rather dense greyish pruinescence; tergite 5, in contrast, smooth and glossy, pruinescent only near lateral margins; in male sternite 8 and in female tergite 6 glossy like tergite 5.

Head slightly higher than long, slightly angularly produced anteriorly so that face is oblique in profile; cheek 0.43–0.50 as high as eye, with numerous fine setulae not reduced to single series anteriorly; face with very slightly

Key to species of *Neosciomyza*

1 Palpus entirely yellow; tergites 3 to 5 thinly pruinescent, subshining ..... *anhecta*, p. 68

—— Palpus grey-brown distally, yellow basally; tergites 3 and 4 densely pruinescent, tergite 5 largely smooth and glossy, pruinescent only towards lateral margins ..... *peckorum*, p. 68

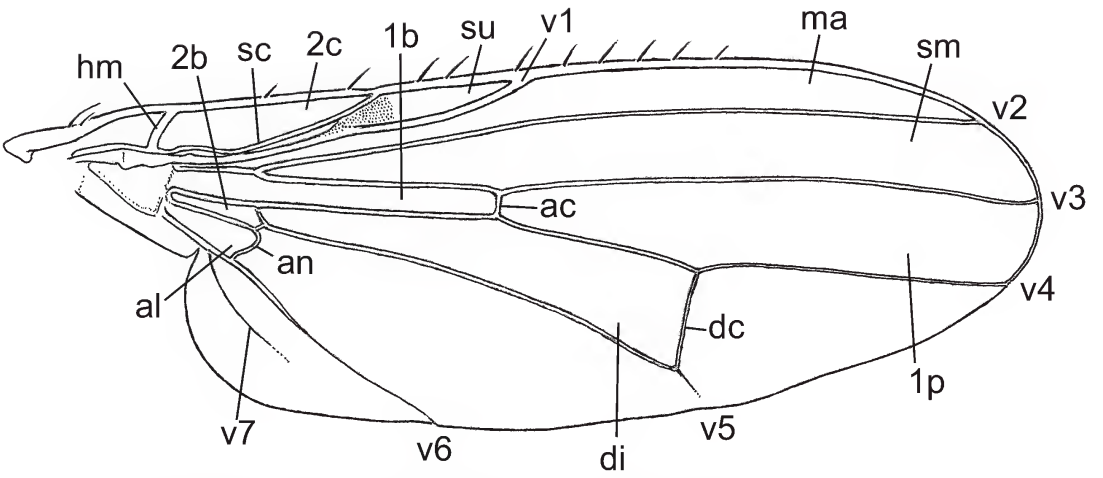


Figure 28. *Neosciomyza peckorum*, left wing of holotype. Longitudinal veins: *sc*, subcosta; *v1–v7*, veins 1 to 7. Crossveins: *ac*, anterior crossvein; *an*, anal crossvein; *dc*, discal crossvein; *hm*, humeral crossvein. Cells: *al*, anal cell; *di*, discal cell; *ma*, marginal cell; *sm*, submarginal cell; *su*, subcostal cell; *1b*, first basal cell; *1p*, first posterior cell; *2b*, second basal cell; *2c*, second costal cell.

raised and rounded medial carina for whole length; cephalic bristles as described for *Helosciomyza bickeli*. Antenna: segment 2 with ventral setulae not as long as in *H. bickeli*, *H. macalpinei*, and related species, more as in *N. anhecta*; pubescence on segment 6 very minute but extending for whole length. Palpus with some distal setulae thickened.

Thorax generally as described for *H. bickeli*; scutellum strongly convex; sternopleuron laterally with very extensively distributed fine setulae (compared with *L. luteipennis*, *H. bickeli*, etc., much as in *N. anhecta*), ventrally with bristles/setulae less strongly developed than in *H. bickeli*; pteropleuron and hypopleuron without setulae. Fore femur with bristles as described for *H. bickeli*; mid femur with subapical posterior bristle, no anterior bristles in male, but few short anterior bristles in female; hind femur of male with many moderately long fine setulae but no bristles, that of female with less development of setulae, but with one or two short, slightly differentiated anterior bristles beyond mid-length; hind tibia with long preapical dorsal bristle, but subapical anterior bristle much finer and more nearly terminal than in most other helosciomyzid species (*N. anhecta* excepted); basitarsi of males with well-developed ventral scopulae (brushes of dense, fine pubescence on plantar surface), that of hind basitarsus extending for most of its length; basitarsi of female apparently without scopulae; fore tarsal segment 4 of male subquadrate, slightly broader than long, that of female distinctly longer than broad. Wing resembling that of *Helosciomyza* spp.; vein 1 terminating in costa slightly beyond level of anterior crossvein.

Abdomen. Sternite 1 vestigial, without setulae; sternite 5 with numerous setulae, posterior ones longer, but none forming pair of dense patches as in males of *H. fuscinevris* group. Male postabdomen: surstylus broad basally, tapered distally, with very small incurved apical tooth, with posterior plate broad, but tapered to upper base, on inner surface partly defined by a raised, curved ridge; basal surstylar process slender, setulose; anterior epandrial process long, without pubescence, apically expanded and compressed, its terminal margin sharp, chisel-like; aedeagus without spine-like epiphallus, with preapical sclerotized segment broadly inflated; cerci joined to proctiger for c. 0.8 of length of each, narrowed distally, relatively broad basally on posterior exposure, with numerous long and short setulae.

Dimensions. Total length, ♂ 6.9–7.3 mm, ♀ 6.7 mm; length of thorax, ♂ 3.1–3.5 mm, ♀ 3.4 mm; length of wing, ♂ 7.8–8.5 mm, ♀ 8.4 mm.

Distribution. Highlands of Australian Capital Territory, Victoria, and New South Wales, as far north as Kanangra-Boyd National Park.

Notes

Neosciomyza peckorum is closely related to *N. anhecta*, from which it is most readily distinguished by having the palpus grey-brown distally (instead of entirely yellow) and abdominal tergite 5 largely smooth and glossy in contrast to the preceding pruinescent tergites (instead of having all preabdominal tergites thinly pruinescent). In the male the anterior epandrial process is more strongly expanded apically, the surstylus is somewhat differently shaped from that of *N. anhecta*, and the preapical segment of the aedeagus is much more inflated than in that species.

All or most specimens were collected in cool highland forest. Most specimens were taken on or near carrion, including a much decayed domestic fowl.

The specific epithet is a noun in the genitive case, plural number, and refers to the collectors Jarmila Kukalová-Peck and Stewart B. Peck.

Genus *Cobergius* Barnes

Cobergius Barnes, 1981: 49–50. Type species (original designation): *C. canus* Barnes [= *Cobergius vittatus* (Macquart)].

Notes

This genus is distinguished by the characters given in the above key. Barnes has emphasized the concave scutellum of *Cobergius*. While the median dorsal concavity of the scutellum is an apparently consistent feature of *C. vittatus*, a similar condition is present in a few dried specimens of *Napaeosciomyza* and *Helosciomyza* spp., probably because of collapse when drying. In the female the sternopleuron is very extensively setulose, as in *Neosciomyza*, but in the male the sternopleuron is long-hirsute with many mollisetae, as is

also the fore femur. The hind femur lacks the anterior bristle in both sexes, a condition approached in *Neosciomyza* (absent in male, reduced in female). The abdominal coloration is distinctive, the tergites being densely ashy grey-pruinescent with distinct dark brown zones.

As previously indicated (D. McAlpine, 1992), *Cobergius* includes a single known species.

Cobergius vittatus (Macquart)

Fig. 3

Helomyza vittata Macquart, 1851: 279, pl. 25, fig. 6.
Cobergius canus Barnes, 1981: 50–51, figs 1, 2.
Cobergius hirsutus Barnes, 1981: 52.
Cobergius vittatus (Macquart).–D. McAlpine, 1992: 90–91.

Type material. See list in D. McAlpine (1992: 91).

Other material examined. Victoria: 3♀♀, Lady Julia Percy Island, W of Port Fairy, Jan. 1936, W.S. (AM, MV).

Distribution. Kangaroo Island to Bass Strait Islands—apparently restricted to island shores.

Notes

Evidence for the above synonymy was discussed by D. McAlpine (1992). Barnes stated, with regard to *C. hirsutus*, "The holotype female has two pairs of fine, black setae on the prosternum, hence the Latin name." In fact, the holotype has one anterior setula on the left side of the prosternum only and two setulae on the membrane near the right side of the prosternum. Other specimens in which the prosternum is exposed have no setulae in this region.

The possibility of an association with fur seal colonies is mentioned above.

ACKNOWLEDGMENTS. Nicole Fisher (ANIC), Ken Walker, and Catriona McPhee (MV) loaned significant collections under their care. Peter Sehnal (NMW) and Ted Edwards (ANIC) provided information on specimens. Stephen Marshall, Michael Driessen, and Günther Theischinger provided important Tasmanian specimens. Suzanne Lindsay carried out electron microscopy. Dan Bickel, Shane McEvey, and Helen Smith made helpful comments on the manuscript.

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New and Little-known Podoceridae (Peracarida: Amphipoda) of Southern Australia

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ABSTRACT. Thirteen taxa in the family Podoceridae are documented for southern Australia, including five new species, three new records and five redescriptions. The redescription of *Cyrtophium minutum* Dana, 1852; *Podocerus dentatus* (Haswell, 1879); *Podocerus hystrix* Stebbing, 1910; *Podocerus inconspicuus* (Stebbing, 1888) and *Podocerus lobatus* (Haswell, 1885) helps clarify existing knowledge of these old taxa.

HUGHES, L. E. 2012. New and little-known Podoceridae (Peracarida: Amphipoda) of southern Australia. *Records of the Australian Museum* 64(1): 71–120.

Prior to this study, nine species of podocerid were known from southern Australia; *Cyrtophium minutum* Haswell, 1879; *Laetmatophilus dabberi* Barnard & Drummond, 1981; *L. hystrix* (Haswell, 1880); *Leipsuropus parasiticus* (Haswell, 1879); *Podocerus dentatus* (Haswell, 1879); *P. hystrix* Stebbing, 1910; *P. inconspicuus* (Stebbing, 1888); *P. laevis* (Haswell, 1885) and *P. lobatus* (Haswell, 1885). With the exception of *Laetmatophilus dabberi*, the Australian fauna is described in the literature before 1911. *Podocerus laevis*, is considered an unidentifiable taxon (Kilgallen, 2009). The following work clarifies the taxonomy of taxa recognized more than a century ago and describes a further five new species. Extensive material housed in state museum collections has provided a valuable resource to investigate variation in podocerid morphology. During this study, material of one historic podocerid taxon was unfortunately not encountered: *Laetmatophilus hystrix* (Haswell, 1880), with the type locality of Port Jackson, Sydney. Based on the original descriptions *L. hystrix* is still considered valid and identifiable.

Podocerids are sexually dimorphic as with most corophiideans, however female podocerids have clearly recognizable species level characters. This is somewhat unusual in the corophiideans where such groups as ampithoid and ischyrocerids show strong sexual dimorphism but little variation in the female form between species (Barnard, 1965).

Characters most useful for species level identification include: pereonite and pleonite carination; gnathopod 1 propodus shape; gnathopod 2 propodus shape, palm sculpting and setal ornamentation. Dorsal carination although highly useful for identification, is not always a species level character and this has contributed to confusion within the family (Pirlot, 1938; Rabindranath, 1972; Ledoyer, 1984).

Species level characters which alter with growth stage include: the relative size of dorsal carnation; gnathopod 1 propodus palm number of robust setae and dactylus posterior margin serrations; and gnathopod 2 propodus palm tooth size (see K. H. Barnard, 1937; Pirlot, 1938; Ledoyer, 1986). All these characters increase in size/number with development. For *P. akanthius* sp. nov. specimens between 3.3–4.5 mm, showed no variation in the number of robust setae on the gnathopod 1 propodus palm. However in *P. dentatus* specimens between 5.0–7.0 mm had five or six palmar robust setae and one individual 5.1 mm with nine robust setae. Variation of gnathopod 2 propodus palm sculpting and tooth development, for the species studied here, did not vary to the degree reported for the well documented *P. chelonophilus* (Chevreux & de Guerne, 1888), (see Baldinger, 2001).

Variation in the maxilla 1 palp robust setae, which can vary between 4 and 6, appears to be stable within the species studied here, and may be useful in future phylogenetic studies. Another interesting phenomenon among species of podocerids is the size relation of pereopod 5–7, which can be either increasing or decreasing in length from pereopods 5 to 7, or have all pereopods subequal in length. This character is usually stable within families for the Amphipoda (Lowry, pers. comm.). Though extremely useful and easily observed, pereopod characters are not always assessable due to the fragile nature of the legs in podocerids, which most often break at death. This variation in pereopods 5–7 length, along with the flexion in the pereonites (particularly the spacing of the pereonite 2), relates to feeding strategy, as described by Barnard *et al.,* 1988, where individuals grasp the substrate with the pereopods and rear the front of the body into oncoming current to filter feed.

Materials and methods

Material examined for this study was an assessment of amphipod holdings predominantly from shallow-water (0–50 m) samples in various collections of the Australian Museum (AM), Museums Victoria (NMV), and South Australian Museum (SAMA). Algae from Batemans Bay 2003 collections were identified by Dr A. Millar, Botanic Gardens, Sydney. Material was dissected in 80% ethanol. Permanent slides were made using Aquatex™ mounting media. Specimens were prepared for electron microscopy as follows: preserving solution was sequentially advance in 5% increments from 80% to 100% ethanol; critical point dried; mounted individually on pins; gold sputter coated and images where captured using on a Zeiss EVO LS15 Scanning Electron Microscope with Robinson Backscatter Detector (SEM). Abbreviations for parts are as follows: *A*—antenna; *F*—accessory flagellum; *G*—gnathopod; *LL*—lower lip; *Md*—mandible; *Mx1*—maxilla 1; *P*—pereopod; *p*—palp; *T*—telson; *U*—uropod and *Ur*—urosome. A map of Australia (Fig. 1) shows locations of places mentioned in the text. Descriptions were generated from a DELTA database of the Podoceridae containing all species in the genera *Cyrtophium, Leipsuropus, Laetmatophilus* and Indo-Pacific species of *Podocerus*.

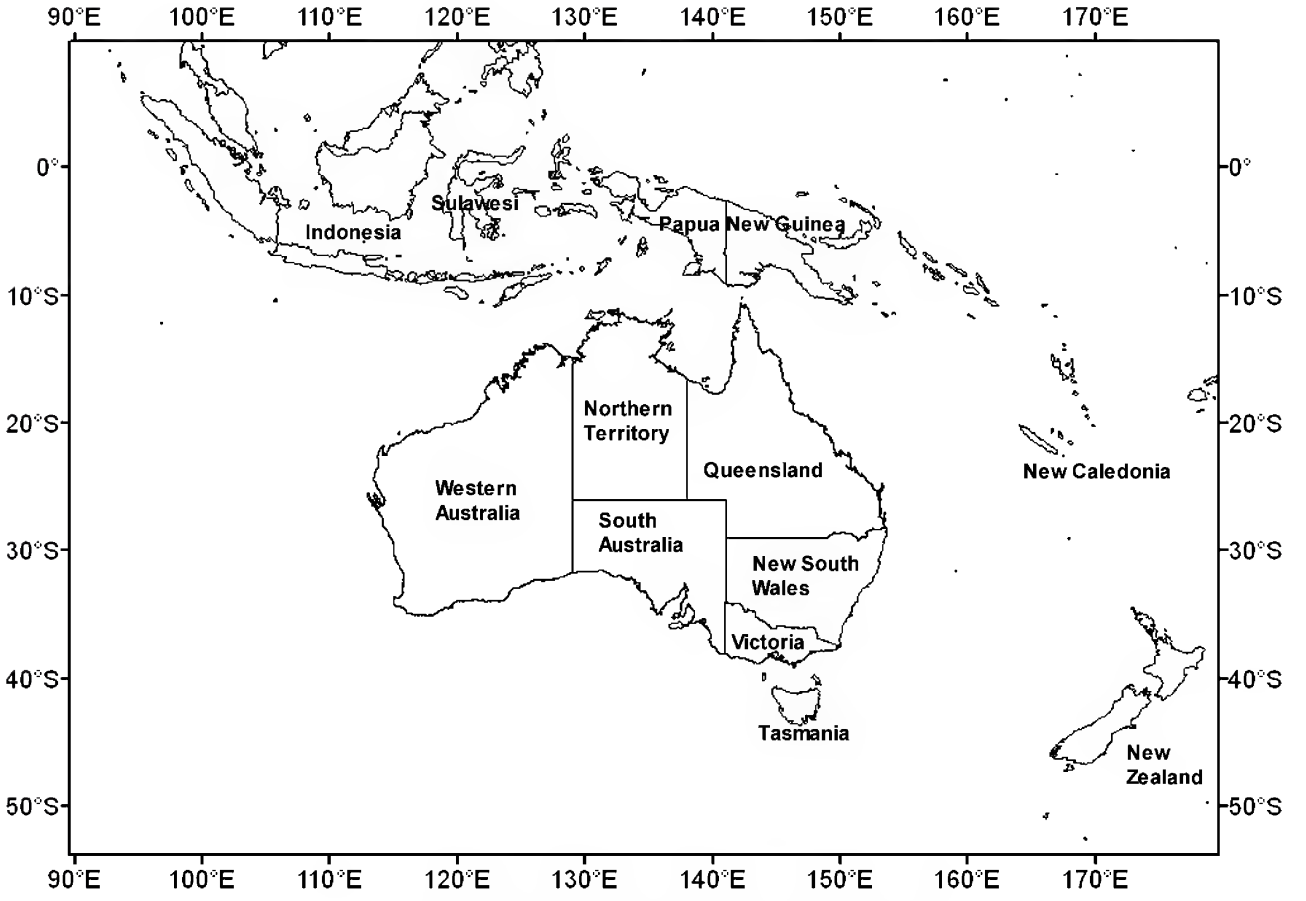

Figure 1. Map of Australian states and countires of the region.

Systematic section

Corophiidea Leach, 1814
Caprelloidea Leach, 1814
Podoceridae Leach, 1814
Podocerinae Leach, 1814

Cyrtophium Dana, 1852

Cyrtophium Dana, 1852: 309.—Dana, 1853: 839.—Stebbing, 1906: 697–698.—J. L. Barnard, 1969: 427.—Laubitz, 1984: 79.—Barnard & Karaman, 1991: 656.

Diagnosis. Amended after Laubitz, 1984: Pereon depressed, with 7 segments; urosome of 3 segments. Antennae 1 accessory flagellum vestigial, scale-like or absent; epistome produced; maxilla 1 inner plate absent, outer plate with 9 spines; maxilla 2 without facial setae; maxilliped palp 4 blunt; gnathopod 2 of female nearly as large as that of male; brood plates on pereopods 2–4; uropod 2 biramus, uropod 3 without rami.

Remarks. Assessment of *C. minutum* has verified the presence of a small scale like accessory flagellum. The generic concept for *Cyrtophium* is therefore expanded to include antenna 1 accessory flagellum vestigial, scale-like or absent. The two remaining species in the genus, *C. laeve* (Heller, 1867) and *C. orientale* (Dana, 1853) are poorly known (Barnard & Karaman, 1991). Further information on these species is required for the genus to be formally reassessed against other genera in the Podoceridae.

Cyrtophium minutum Haswell, 1879

Figs 2–4

Cyrtophium minutum Haswell, 1879: 343, pl. 22 fig. 6f, g.—Haswell, 1885: 109, pl. 18, figs 1–5, 9.—Stebbing, 1906: 698.—Stebbing, 1910: 650.—Springthorpe & Lowry, 1994:25.—Lowry & Stoddart, 2003: 245 (catalogue).

Type material. Possible syntypes, 13 specimens, AM P.3425, Port Jackson, New South Wales (33°51'S 151°16'E).

Type locality. Port Jackson, Sydney, New South Wales, Australia.

Material examined. *New South Wales*. 1 SEM pin mounted specimen, 3.5 mm, AM P.78208, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 19 m, on surface of sponges, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1278); 1 SEM pin mounted specimen, AM P.78209, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 19 m, on surface of sponges, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1278); 1 male, 3.0 mm, dissected, 2 slides, AM P.86148, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 16 m, bryozoans *Scuticella plagiostoma* and *Orthoscuticella* sp., 1 May 1997, coll. P. B. Berents (NSW 1284); 1 female specimen, 3.6 mm, dissected, 2 slides, AM P.86216, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 19 m, on surface of sponges, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1278); 9 specimens, AM P.77153, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 16 m, bryozoans *Scuticella plagiostoma* and *Orthoscuticella* sp., 1 May 1997, coll. P. B. Berents (NSW 1284); many specimens, AM P.77144, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 19 m, on surface of sponges, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1278); many specimens, AM P.77147, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 17 m, bryozoan *Margaretta barbata* on wall, 1 May 1997, coll. P. B. Berents (NSW 1280); many specimens, AM P.77149, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 18 m, hydrozoan and bryozoan, 1 May 1997, coll. P. B. Berents (NSW 1281); many specimens, AM P.77156, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 18 m, sponge and gorgonacean, 1 May 1997, coll. K. B. Attwood (NSW 1286); 1 specimen, AM P.77162, Golf Course Bommie, 500 m northeast of Ulladulla Head (35°20'28"S 150°29'12"E), 10 m, algal turf, 2 May 1997, coll. P. B. Berents and K. B. Attwood (NSW 1293); 1 specimen, AM P.77163, Golf Course Bommie, 500 m northeast of Ulladulla Head (35°20'28"S 150°29'12"E), 14 m, clump of dead *Filograna* sp. polychaete tubes on vertical face of large boulder, 2 May 1997, coll. P. B. Berents (NSW 1299); 1 specimen, AM P.77168, Halfway Reef, 200 m south of Sullivan Reef, Ulladulla (35°21'25"S 150°29'18"E), 15 m, airlift over wall of sponges, Bryozoa, Hydrozoa, 3 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1307); 1 specimen, AM P.77175, 50 m east of Sullivan's Reef, Ulladulla (35°21'19"S 150°29'22"E), 24 m, gorgonacean, 5 May 1997, coll. P. B. Berents (NSW 1326); 1 specimen, AM P.77179, northern side of Bannister Head, north of Batemans Bay (35°19'9"S 150°29'7"E), 18 m, 6 May 1997, coll. K. B. Attwood (NSW 1344); 4 specimens, AM P.77183, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 21 m, low tufting brown and coralline algae, 7 May 1997, coll. A. Murray (NSW 1351); 3 specimens, AM P.77187, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 22 m, red alga, 7 May 1997, coll. A. Murray (NSW 1356); 1 specimen, AM P.86146, sewerage pipeline, Nelson Bay, Port Stephens (32.71968 152.14122), 10 m, branched green sponge, ascidians, pennatulacean, 15 March 2006, coll. K. B. Attwood (NSW 3041); 1 specimen, AM P.86147, sewerage pipeline, Nelson Bay, Port Stephens (32°43'10"S 152°8'28"E), 10 m, mass of intertwined dead algae, 15 March 2006, coll. K. B. Attwood (NSW 3042).—*Victoria*. Many specimens, AM P.86154, Gabo Island (37°33'S 149°54'E), 30 m, rocky bottom kelp bed, 4 June 1981, coll. V. Harriet and L.Vail (G2).

Diagnosis. *Coxa 1–7* contiguous. *Gnathopod 1* propodus subrectangular, without robust seta at corner of palm. *Gnathopod 2* basis as long as broad; palm with one distal subtriangular tooth, palm defining corner with tooth and without robust setae.

Female *Gnathopod 1* propodus rectolinear, palm margin smooth, without palm defining margin or robust setae. *Gnathopod 2* propodus spherical, palm defined by corner with 3 robust setae.

Description. Based on male, 3.0 mm, AM P.86148. *Body* cuticle dorsally smooth. *Head* dorsally smooth; *eyes* greatly bulging; lateral cephalic lobe subquadrate. *Antennae 1* 0.6 times body length; subequal to antennae 2; primary flagellum 0.5 times peduncle length, with 3 articles; accessory flagellum, minute, scale-like, 1-articulate. *Antennae 2* peduncle article 4 subequal in length to article 5; flagellum 0.4 times peduncle length, posterior margin with robust setae (based on female AM P.86216). *Mandible* accessory setal row with 3 setae. *Maxilla 1* palp distal margin with 4 robust setae.

Coxa 1–7 contiguous. *Gnathopod 1* coxa smaller than coxa 2, broader than long, distoventral corner not produced; basis 3 times as long as broad, without anterodistal setae; carpus rectolinear, 1.8 times as long as broad; propodus subrectangular, 2.1 times as long as broad, anterior margin with sparse long slender setae, palm margin smooth, without robust seta at corner of palm; dactylus posterior margin with 3 serrate teeth, cuticle surface smooth, closing along palm. *Gnathopod 2* basis as long as broad, anterodistal corner subquadrate, without setae; merus posterior margin with broad produced lobe, twice as broad as long, apically rounded, without short robust setae; propodus subovate, 1.8 times as long as broad, anterior margin with clusters of short slender setae, palm ⅔ length of propodus, with broad, well developed distal shelf, shelf margin crenulated, palm with

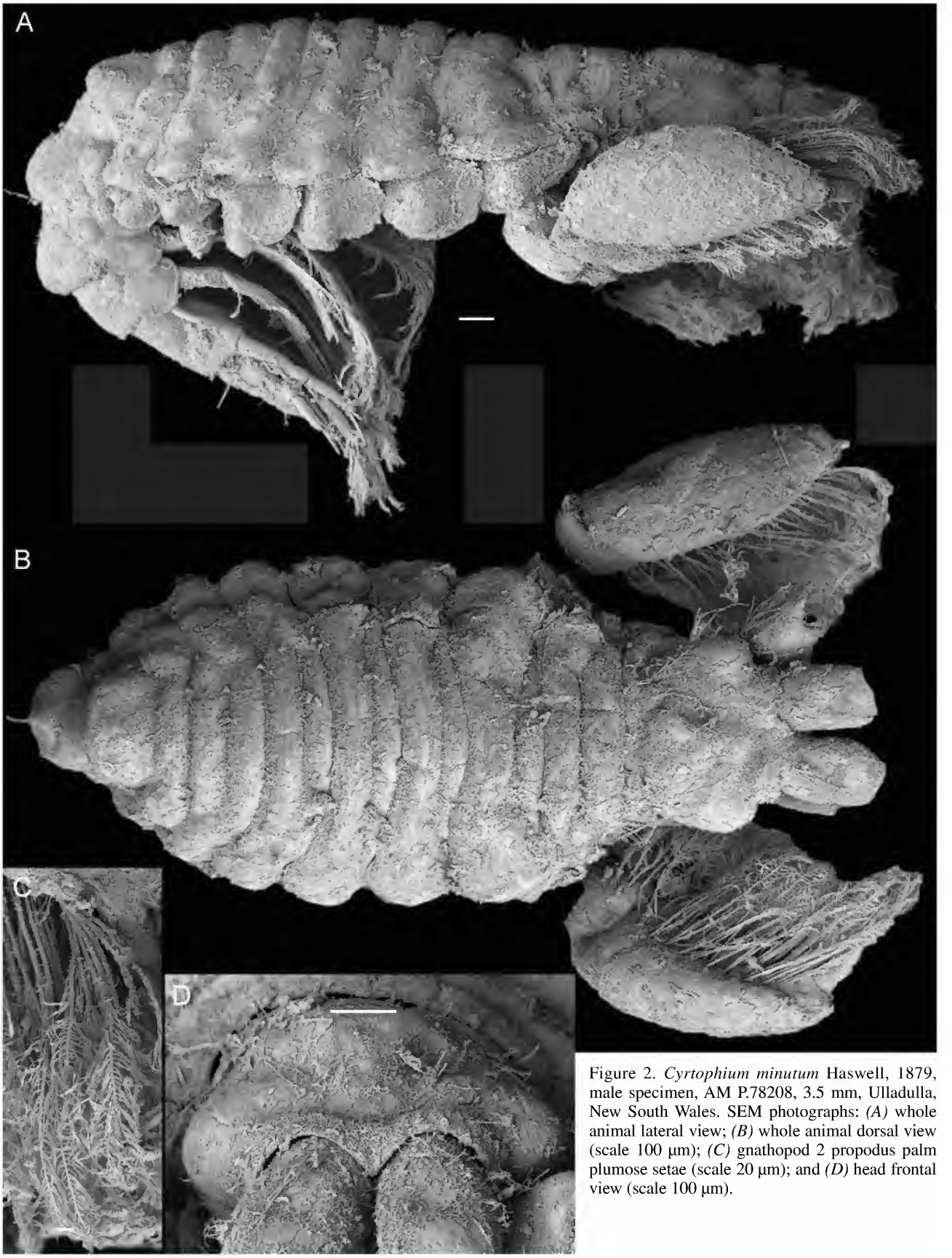

Figure 2. *Cyrtophium minutum* Haswell, 1879, male specimen, AM P.78208, 3.5 mm, Ulladulla, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 100 µm); *(C)* gnathopod 2 propodus palm plumose setae (scale 20 µm); and *(D)* head frontal view (scale 100 µm).

one distal subtriangular tooth, palm defining corner with tooth, without robust setae; dactylus closing short of palm.

Epimera 1–3 posteroventral corner rounded. *Urosome* with 3 pairs of uropods. *Urosomite 1* short, 1.5 times as long as broad. *Uropod 1* peduncle 2.8 times as long as broad, without ventromedial spine; inner ramus 1.1 times peduncle length, outer ramus about half the length of inner ramus. *Uropod 2* well developed, biramus, without

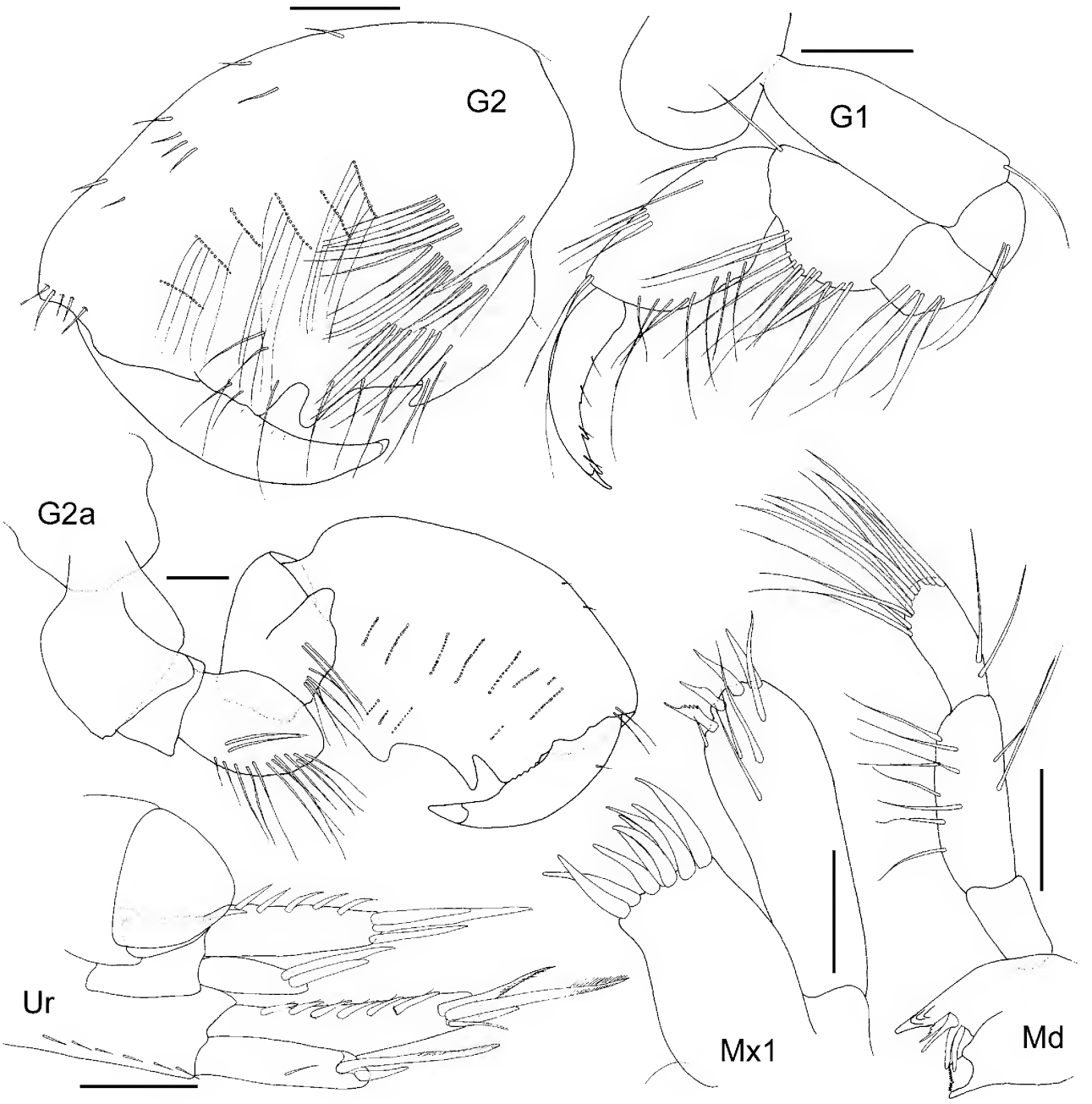

Figure 3. *Cyrtophium minutum* Haswell, 1879, male AM P.86148, 3.0 mm, Ulladulla, New South Wales (scales represent 0.1 mm).

ventromedial spine; outer ramus about half the length of inner ramus. *Uropod 3* uniramus, rami without apical setae. *Telson* apically rounded, dorsal lobe absent, without lateral or apical setae.

Female (sexually dimorphic characters) based on female specimen, 3.6 mm, AM P.86216.

Gnathopod 1 basis without anterodistal robust setae; carpus rectolinear, twice as long as broad; propodus rectolinear, twice as long as broad, palm margin smooth, weakly convex, without palm defining margin or robust setae; dactylus posterior margin with 3 serrate teeth. *Gnathopod 2* basis anterior margin subquadrate, without robust setae; merus lobes 1.3 times as long as broad, anterior margin apically subacute, without robust setae; propodus spherical, 1.2 times as long as broad, anterior margin with clusters of long slender setae, palm convex, smooth, about half length of propodus, without distal shelf, palm defined by corner with 3 robust setae.

Remarks. *Cyrtophium minutum* is superficially similar to another Australian species *Podocerus lobatus* in the male gnathopod 1 propodus palm without robust setae and gnathopod 2 propodus palm sculpting with distal and palm defining tooth. In *C. minutum* antenna 1 is subequal in length to antenna 2, while antenna 1 is shorter than antenna 2 in *P. lobatus*. *Cyrtophium minutum* has a body plan which is tending towards dorsoventrally flattened.

Distribution. Australia. *New South Wales*. Port Jackson (Haswell, 1879), Port Stephens, Ulladulla (current study). *Victoria*. Gabo Island (current study).

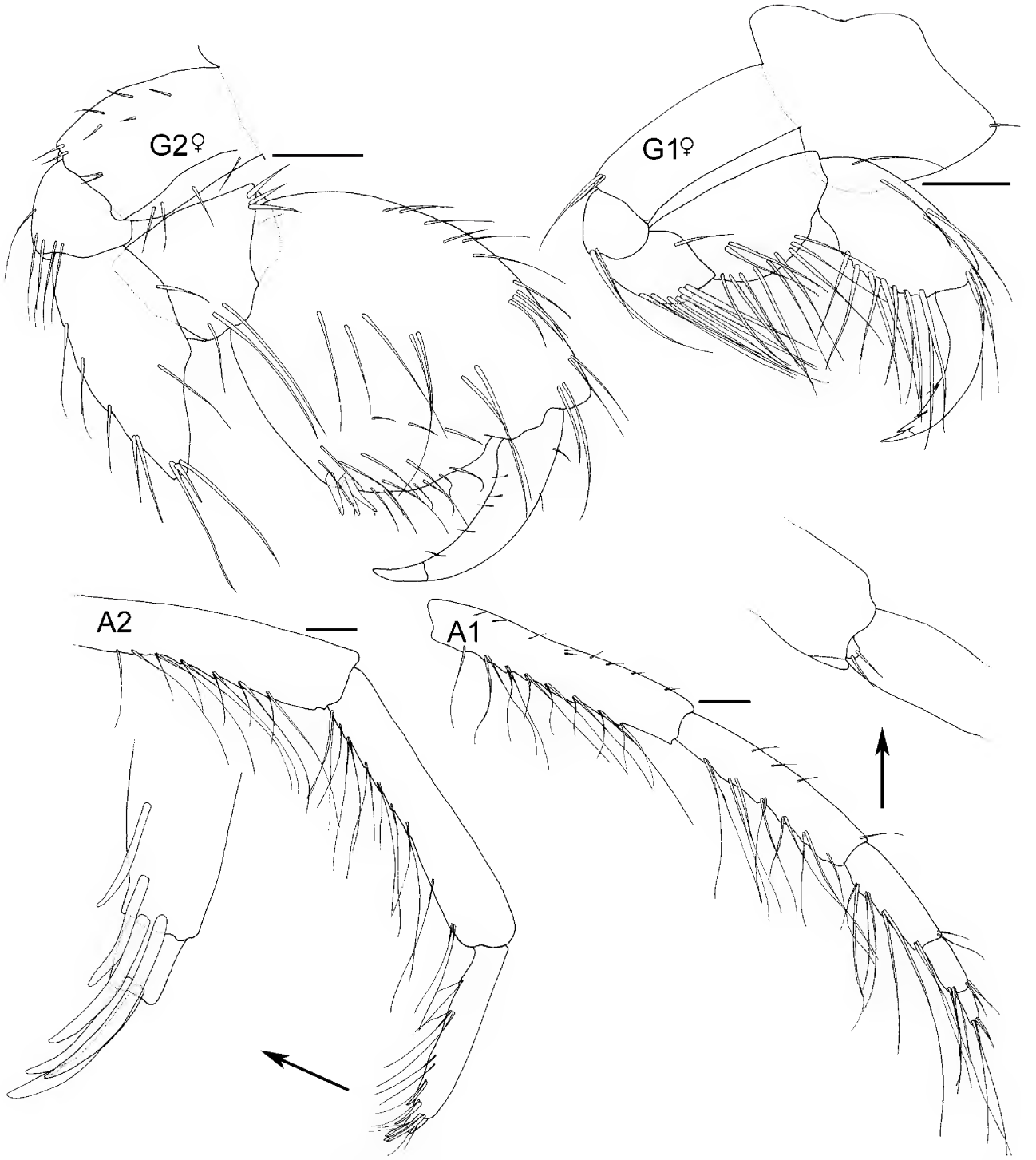

Figure 4. *Cyrtophium minutum* Haswell, 1879 female AM P.86216, 3.6 mm, Ulladulla, New South Wales (scales represent 0.1 mm).

Leipsuropus Stebbing, 1899

Leipsuropus Stebbing, 1899: 237–241.—Stebbing, 1906: 698.—J. L. Barnard, 1969: 430.—Laubitz, 1984: 79.

Diagnosis. Following Laubitz, 1984: Pereon depressed with segments 6 and 7 partially fused; urosome of 3 segments. Antennae 1 accessory flagellum absent; epistome produced; maxilla 1 inner plate absent, outer plate with 8 spines; maxilla 2 without facial setae; maxilliped palp 4 blunt; gnathopod 2 of female nearly as large as that of male; brood plates on pereopods 2-4; uropod 2 absent, uropod 3 without rami.

Leipsuropus parasiticus (Haswell, 1879)

Fig. 5

Cyrtophium parasiticum Haswell, 1879: 274.—Haswell, 1882: 271.—Haswell, 1885: 108, pl. 17 figs 1–7.
Leipsuropus parasiticus.—Stebbing, 1906: 339.—Stebbing, 1910: 650.—Barnard & Drummond, 1981: 38, figs 6, 7.—Barnard & Karaman, 1991: 662.—Springthorpe & Lowry, 1994:28.—Lowry & Stoddart, 2003: 245 (catalogue).

Type material. Syntypes 3 specimens, AM G.5388; 14 specimens, AM P.3426, Port Jackson, New South Wales (33°51'S 151°16'E).

Figure 5. *Leipsuropus parasiticus* (Haswell, 1879) male specimen, AM P.78202, Botany Bay, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 200 μm); *(C)* lateral view of head (scale 20 μm); and *(D)* gnathopod 2 propodus palm plumose setae (scale 20 μm).

Type locality. Port Jackson, Sydney, New South Wales, Australia (33°51'S 151°16'E).

Material examined. *New South Wales*. 1 SEM pin mounted specimen, AM P.78202, Bare Island (33°59'31"S 151°13'49"E), 12 m, on sponge, 13 August 1998, coll. M. J. Huggett and R. De Nys; 1 SEM pin mounted specimen, AM P.78203, Bare Island, Botany Bay (33°59'31"S 151°13'49"E), 12 m, on sponge, 13 August 1998, coll. M. J. Huggett and R. De Nys; 1 SEM pin mounted specimen, AM P.78204, Bare Island, Botany Bay (33°59'31"S 151°13'49"E), 12 m, on sponge, 13 August 1998, coll. M. J. Huggett and R. De Nys; many specimens (including 1 dissected male "A", 3 slides), AM P.77115, Bare Island, Botany Bay (33°59'31"S 151°13'49"E), 12 m, on sponge, 13 August 1998, coll. M. J. Huggett and R. De Nys; many specimens, AM P.77172, 50 m east of Sullivan's Reef, Ulladulla, (35°21'19"S 150°29'22"E), 23 m, orange/red finger sponge, 5 May 1997, coll. R. Springthorpe (NSW 1320); 9 specimens, AM P.77174, 50 m east of Sullivan's Reef, Ulladulla, New South Wales (35°21'19"S 150°29'22"E), 23 m, brown algae *Dictyota* sp., 5 May 1997, coll. A. Murray (NSW 1324); many specimens, AM P.83999, north east side of Cabbage Tree Island, north east of Port Stephens (32°41'6"S 152°13'36"E), 16.9 m, assorted compound ascidians from rocks in sand, steeply sloping boulder reef meeting flat sand bottom, 8 March 2006, coll. S. J. Keable, RV *Baragula* (NSW 2880).

Remarks. *Leipsuropus* is a monotypic genus recognizable by the coalesced pereonites 6–7. *Leipsuropus parasiticus* can be identified from other Australian podocerid species by the distinctive dorsoventrally flattened body, which when viewed dorsally appears subovoid.

Distribution. Australia. *New South Wales*. Port Jackson (Haswell, 1879); Botany Bay; Port Stephens; Ulladulla (current study). *Victoria*. Western Port (J. L. Barnard & Drummond, 1981).

Podocerus Leach, 1814

Podocerus Leach, 1814: 433.—Stebbing, 1906: 700.—J. L. Barnard, 1970: 237.—Lincoln, 1979: 570.—Barnard & Karaman, 1991: 664. (Type species *Podocerus variegatus* Leach, 1814 by monotypy).

Platophium Dana, 1852: 309.—Dana, 1853: 837 (Type species *Platophium brasiliense* Dana, 1853 by monotypy).

Dexiocerella Haswell, 1885: 107 (Type species *Cyrtophium dentatum* Haswell, 1879 subsequent selection of Barnard & Karaman, 1991).

Diagnosis. Amended after Laubitz, 1984: Pereon depressed, with 5–7 segments; urosome of 3 segments. Antennae 1 accessory flagellum present; maxilla 1 inner plate reduced and non-setose or absent, outer plate with 9 spines; maxilla 2 without facial setae; maxilliped palp 4 blunt; brood plates on pereopods 2–4 or 2–5; uropod 2 uniramus or biramus; uropod 3 without rami.

Remarks. The generic description of the uropod 2 is expanded to include a uniramus aswell as biramus character state, based on the inclusion of *P. tamoshanta* sp. nov.

Podocerus akanthius sp. nov.

Figs 6–8

Type material. Holotype male, 4.4 mm, dissected, 2 slides, AM P.86150; paratype male, 4.4 mm, dissected, 2 slides, AM P.86152; paratype male, dissected, 3 slides, AM P.86153; paratype female, 4.1 mm, dissected, 1 slide, AM P.86151; paratypes 20+ specimens, AM P.77311, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), subtidal rocks algal washings, 9 October 1984, coll. S. J. Keable and J. T. van der Velde (Site Q4); paratype 1 SEM pin mounted specimen, AM P.78212, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), subtidal rocks algal washings, 9 October 1984, coll. S. J. Keable and J. T. van der Velde (Site Q4); paratype 1 SEM pin mounted specimen, AM P.78213, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), subtidal rocks algal washings, 9 October 1984, coll. S. J. Keable and J. T. van der Velde (Site Q4); paratypes 18 specimens, AM P.35997, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), 1.5 m, subtidal rock platform, 9 October 1984, coll. S. J. Keable and J. T. van der Velde (Q1).

Type locality. Murrumbulga Point, Twofold Bay, New South Wales, Australia (37°4'42"S 149°53'6"E).

Etymology. From the Greek *akanthias*, meaning a prickly thing, a kind of shark. Applied in reference to the dorsal carina, which are reminiscent of shark fins.

Additional material examined. *New South Wales*. 3 specimens, AM P.77166, Halfway Reef, 200 m south of Sullivan Reef, Ulladulla (35°21'25"S 150°29'18"E), 13 m, brown alga on rock ledge, 3 May 1997, coll. A. Murray (NSW 1305); many specimens, AM P.77323, off Providential Head, Wattamolla (34°8'S 151°8'30"E), 70 m, 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (T3–95).—*Victoria*. 3 specimens, NMV J56908, east of Eagles Nest (38°40'46"S 145°39'14"E), 5–11, m, 1 April 1997, coll. T. O'Hara (BUN 4); 5 specimens, NMV J57227, off Cape Paterson Club House, Bunurong (38°40'39"S 145°37"13'E), 10–11 m, 1 April 1997, coll. T. O'Hara (BUN 1); 2 specimens, NMV J57228, off Honeysuckle Hill, Bunurong (38°40'32"S 145°37'47"E), 10–11 m, 1 April 1997, coll. T. O'Hara (BUN 2); 5 specimens, NMV J57229, off Honeysuckle Hill, Bunurong (38°40'32"S 145°37"47'E), 10–11 m, 1 April 1997, coll. T. O'Hara (BUN 2).—*Tasmania*: 3 specimens, AM P.83634, Joe's Bight, Freycinet Peninsula (42°16'42"S 148°18'42"E), 17 m, brown algae, 1 May 1991, coll. S. J. Keable and R. T. Springthorpe (Tas 334); 1 female specimen, SAMA C6553, north of boat ramp, Mason Cove, Port Arthur, Tasman Peninsula (43°8'52"S 147°51"6'E), 1–3 m, algae, 13 July 1991, coll. K. L. Gowlett-Holmes and G. Myors.—*South Australia*: 1 A male, 4.5 mm, dissected, 4 slides; 1 A female, dissected, 4 slides, 1 b male, 4.4 mm, dissected, 4 slides, 1 c male specimen, dissected, 4.0 mm, 1 slide, 1 d male specimen, dissected, 4.6 mm, 2 slides, 1 e male specimen, dissected, 4.1 mm, 1 slide, 1 f male specimen, dissected, 3.3 mm, 1 slide, 1 g female specimen, dissected, 3.2 mm, 1 slide, many specimens, SAMA C6593, Victor Harbour, Fleurieu Peninsula (35°30'36"S 138°36'17"E), 10 m, mixed brown fucoid macroalgae, February 2002, coll. A. Hirst, SARDI Encounter Expedition 2002; 6 specimens, SAMA C6595, Victor Harbour, Fleurieu Peninsula (35°30'36"S 138°36'17"E), 6 m, mixed brown fucoid macroalgae, February 2002, coll. A. Hirst, SARDI Encounter Expedition 2002; many specimens, SAMA C6591, Sellicks Beach, Fleurieu Peninsula (35°19'47"S 138°26'52"E), 16 January 1937, coll. H. M. Hale and K. Sheard; 6 specimens, SAMA C6598, western side of Cape D'Estaing, Kangaroo Island (35°34'S 137°29'E), 10–12 m, reef, crevices, rubble, 27 January 1989, coll. W. Zeidler and K. L. Gowlett-Holmes; 8 specimens, SAMA C6563, North Point, St Francis Island, Nuyts Archipelago (32°29'18"S 133°17"E), 9 m, kelp dominated habitat, February 2002, coll. A. Hirst, SARDI Encounter Expedition 2002; many specimens, SAMA C6564, northwest of Freeling Island, Nuyts Archipelago (33°27'53"S 133°20'30"E), 8 m, mixed brown fucoid macroalgae, February 2002, coll. A. Hirst, SARDI Encounter Expedition 2002; many specimens, SAMA C6565, northeast cove, West Island, Nuyts Archipelago (32°30"30'S, 133°14"48'S), 10 m, mixed brown fucoid macroalgae, February 2002, coll. A. Hirst, SARDI Encounter Expedition 2002; 1 specimen, SAMA C6734, Fowlers Bay Jetty, West of Ceduna (31°59'23"S 132°26'20"E), 4–5 m, 2 March 1993, coll. W. Zeidler, K. L. Gowlett-Holmes and B. McHenry; 10 specimens, NMV J57051, Flinders Island, "The Hotspot" reef, 5 nautical miles west of northern end of Flinders Island (33°40'30"S 134°22'00"E), 17 m, 19 April 1985 (SA 65); 50 specimens, NMV J62396, northeastern side of Topgallant Island, Investigator Island Group (33°43'00"S 134°36'36"E), 7 m, 22 April 1985 (SA 83); 1 specimens, NMV J57053, "The Hotspot" reef, 5 nautical miles west of northern end of Flinders Island (33°40'48"S 134°22'30"E), 21 m, 20 April 1985 (SA 70).—*Western Australia*. 2 specimens, AM P.79829, reef west of groyne, 2 km south of Cape Peron (32°16'S 115°41'E), 3 m, deep channels in limestone reef, tough red alga, 26 December 1983, coll. R. Springthorpe (WA 299); 7 specimens, AM P.79828, 2 km southeast of South Point, Two Peoples Bay (34°58'S 118°12'E), 5 m, brown algae with zigzag stem on rock shelf, 16 December 1983, coll. R. Springthorpe (WA 171); many specimens, AM P.79844, Vancouver Peninsula, near Mistaken Island, King George Sound

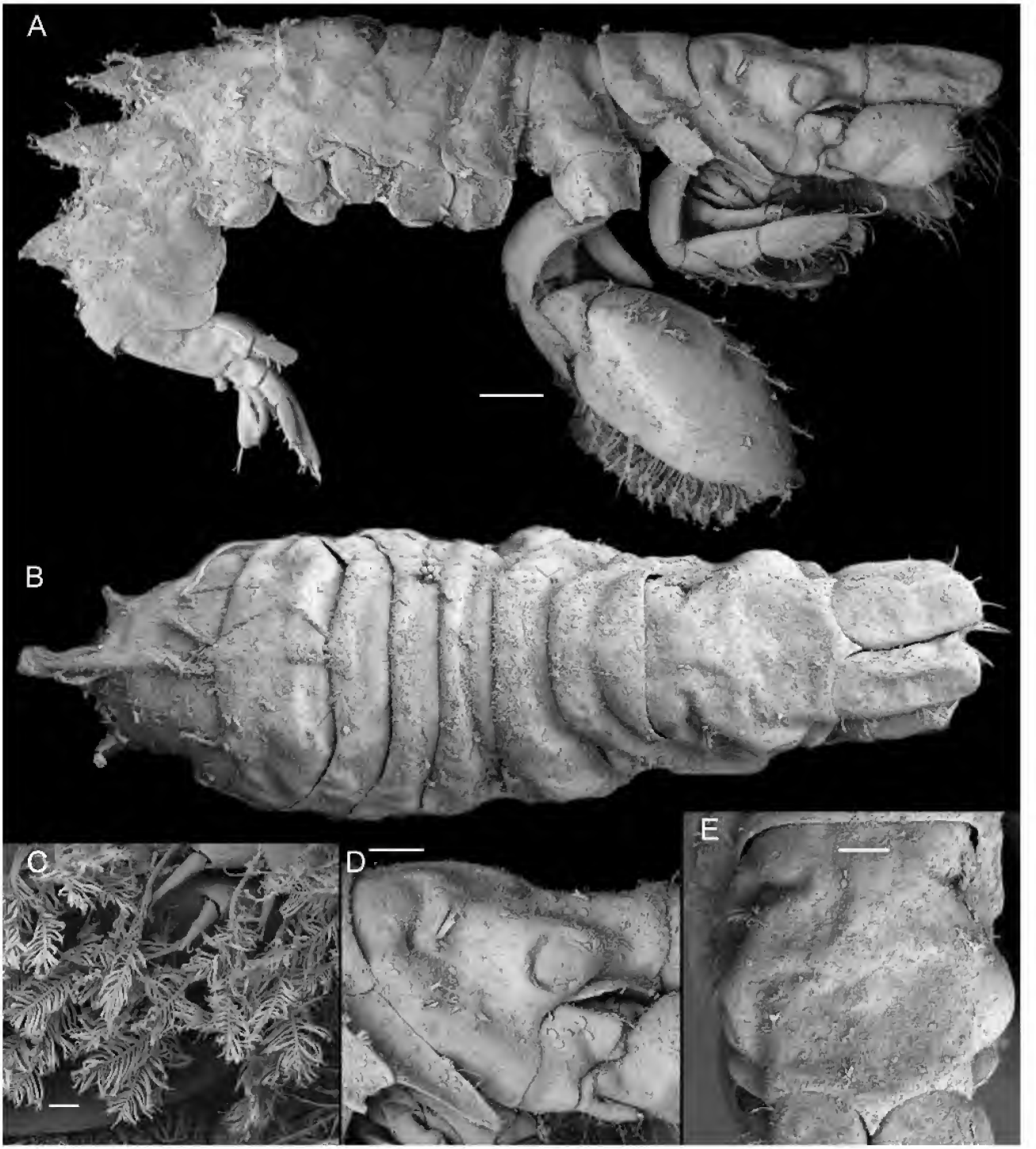

Figure 6. *Podocerus akanthius* sp. nov. male specimen, AM P.78213, Twofold Bay, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 200 μm); *(C)* gnathopod 2 propodus palm plumose setae (scale 30 μm); *(D)* head lateral view (scale 100 μm); and *(E)* head dorsal view (scale 100 μm).

(35°4'S 117°56'E), 2 m, grey sponge with crinoids, 13 December 1983, coll. R. Springthorpe (WA 114); 11 specimens, AM P.79845, Vancouver Peninsula, Kalbarri, Albany (35°4'S 117°56'E), 2 m, soft corals, 13 December 1983, coll. J. K. Lowry (WA 105); 7 specimens, AM P.79488, near Shelley Beach, rocky shore, Bunker Bay, south of Busselton, near Cape Naturaliste (33°32'33"S 115°1'47"E), 0.5 m, on mixed brown algae *Cystophora* sp. and *Sargassum* sp., 4 December 2000, coll. R. A. Peart (WA 729); 1 specimen, NMV J56989, north side, Cape Riche (34°37'00"S 118°47'00"E), 7.0 m, 14 April 1984 (SWA 49).

Diagnosis. *Head* dorsally smooth; *Gnathopod 1* propodus subrectangular, palm margin minutely serrate, with 4 robust setae near corner of palm. *Gnathopod 2* propodus elongate, subovoid, propodus palm acute, straight, smooth, without distal shelf. *Pereonite 7* dorsal carina produced posteriorly, subtriangular, apically acute. *Pleonite 1–2* dorsal carina produced posteriorly, subtriangular, apically acute.

Female *Gnathopod 1* carpus rectolinear, twice as long as broad; propodus subovate, twice as long as broad, palm convex, margin minutely serrate, defined by 2 robust setae, without palm defining corner. *Gnathopod 2* basis anterior margin subquadrate; merus lobe as broad as long, posterior

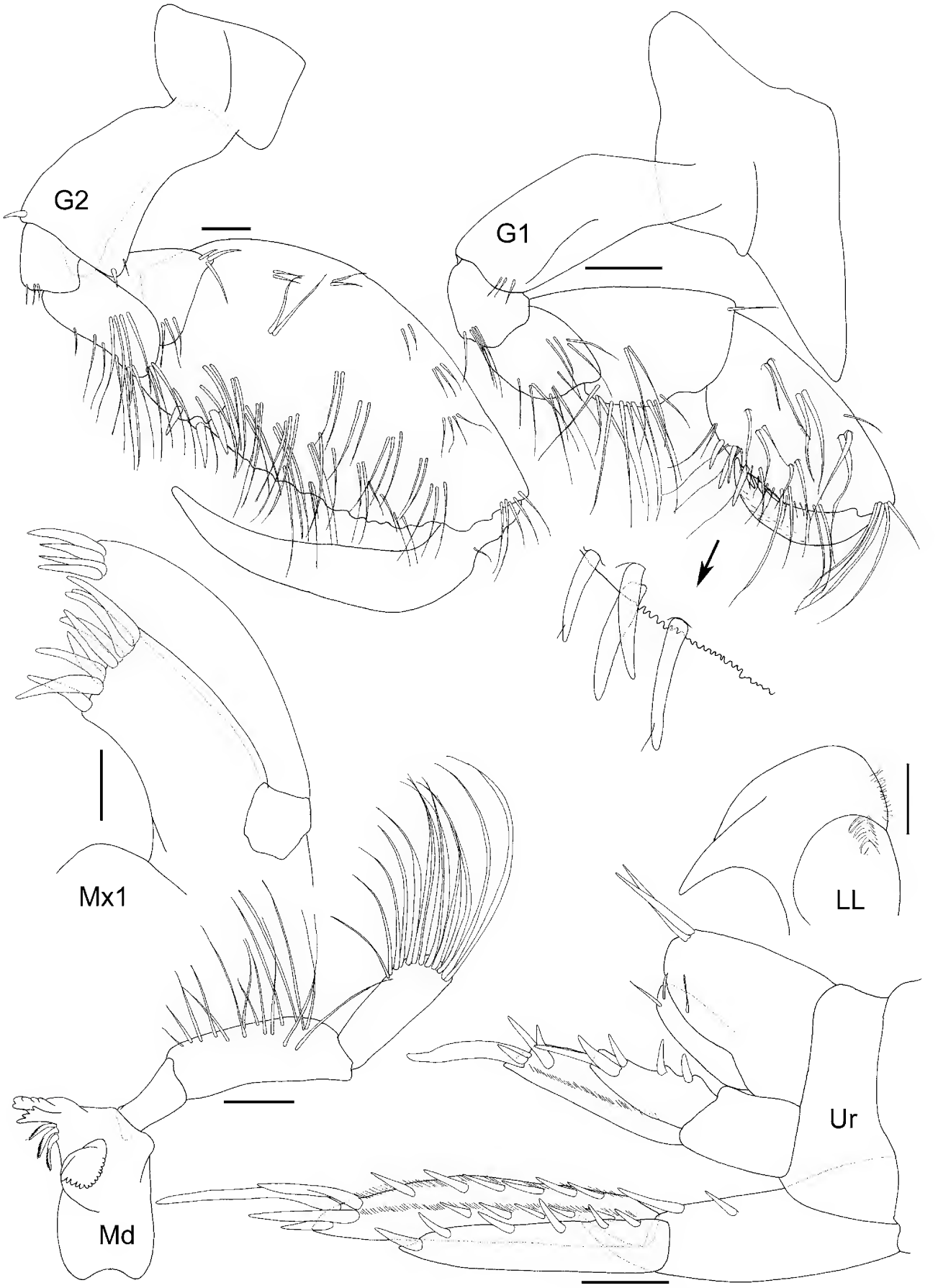

Figure 7. *Podocerus akanthius* sp. nov., holotype male AM P.86150, 4.4 mm, Twofold Bay, New South Wales (scales represent 0.1 mm).

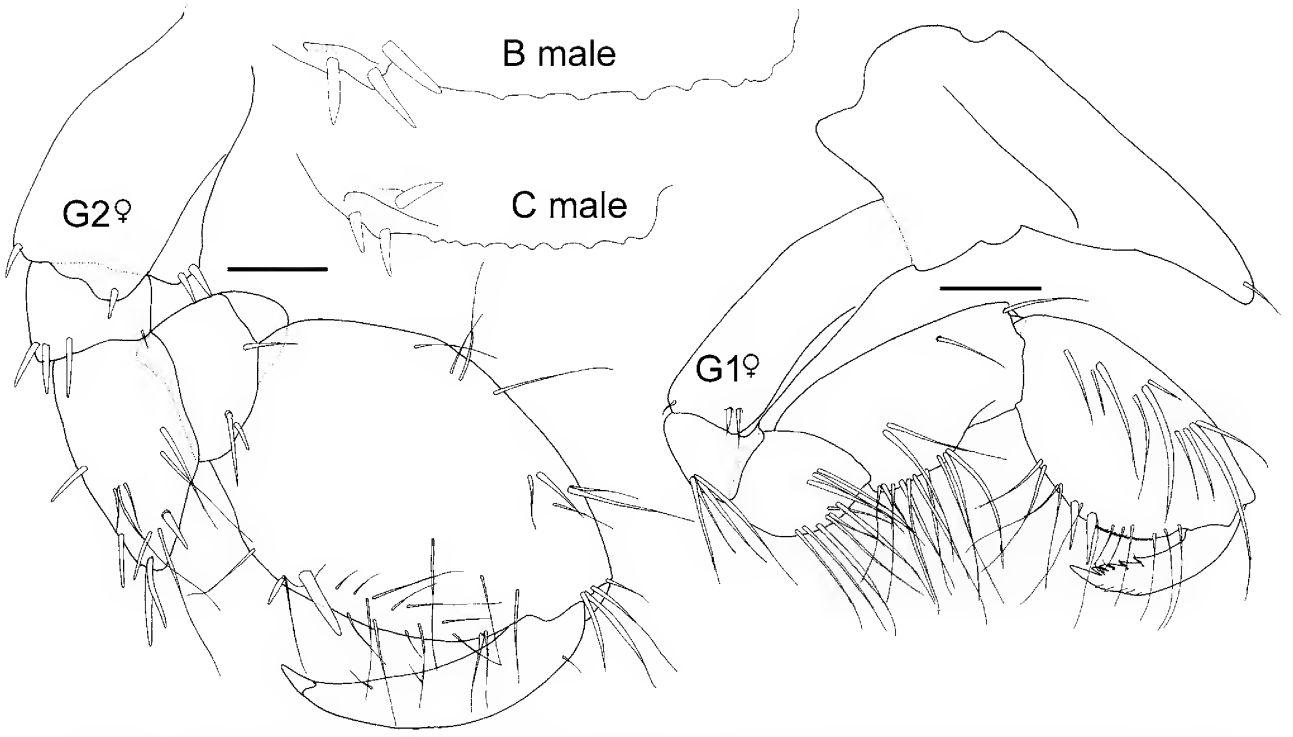

Figure 8. *Podocerus akanthius* sp. nov., paratype female, AM P.86153, 4.1 mm, Twofold Bay, New South Wales (scales represent 0.1 mm).

margin with 1 short and 2 long robust setae; propodus subovate, palm smooth, defined by 2 robust setae without palm defining corner.

Description. Based on holotype male, 4.4 mm, AM P.86150. *Body* cuticle dorsally processiferous, with mainly posterior dorsal carina, without lateral and ventral carina. *Head* dorsally smooth; *eyes* greatly bulging; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Mandible* accessory setal row with 3 setae. *Maxilla 1* palp distal margin with 4 robust setae. *Pereonites 1–6* without dorsal carina. *Coxae 1–3* discontiguous, *coxae 4–7* contiguous. *Gnathopod 1* coxa subequal to coxa 2, broader than long, distoventral corner elongate produced ventrally; basis 2.5 times as long as broad, with a few slender anterodistal setae; carpus rectolinear, twice as long as broad; propodus subrectangular, 2.2 times as long as broad, anterior margin with sparse slender setae, palm margin minutely serrate, with 4 robust setae near corner of palm; dactylus posterior margin with 2 serrate teeth, cuticle surface with raised serrations, closing along palm. *Gnathopod 2* basis twice as long as broad, anterodistal corner produced into rounded lobes, with short robust setae; merus posterior margin with broad produced lobe, 1.1 times as broad as long, apically rounded, without short robust setae; propodus elongate, subovoid, 2.1 times as long as broad, anterior margin with clusters of short slender setae, propodus palm acute, straight, smooth, ¾ length of propodus, without distal shelf, palm defined by corner with 3 robust setae; dactylus closing along palm. *Pereonite 7* dorsal carina produced posteriorly, subtriangular, apically acute.

Pleonite 1 dorsal carina produced posteriorly, subtriangular, apically acute; *epimeron 1* posteroventral corner rounded. *Pleonite 2* dorsal carina produced posteriorly, subtriangular, apically acute; *epimeron 2* posteroventral corner rounded. *Epimeron 3* posteroventral corner subquadrate. *Urosome* with 3 pairs of uropods. *Urosomite 1* twice as long as broad. *Uropod 1* peduncle elongate, 3 times as long as broad, with well developed ventromedial spine 3 times as long as broad; inner ramus 1.3 times peduncle length, outer ramus about ¾ length of inner ramus. *Uropod 2* well developed, biramus, without ventromedial spine; outer ramus about half the length of inner ramus. *Uropod 3* uniramus; rami with apical setae. *Telson* dorsal lobe with 2 apical setae; lower margin with pair of long slender lateral setae, without apical setae.

Female (sexually dimorphic characters) based on paratype 1 female, 4.1 mm, AM P.86151. *Gnathopod 1* basis anterior margin with 2 robust setae; carpus rectolinear, twice as long as broad; propodus subovate, twice as long as broad, palm convex, margin minutely serrate, defined by 2 robust setae, without palm defining corner; dactylus posterior margin with 5 serrate teeth. *Gnathopod 2* basis anterior margin subquadrate, with several robust setae; merus lobe as broad as long, posterior margin with 1 short and 2 long robust setae; propodus subovate, 1.9 times as long as broad, anterior margin with a few long slender setae, palm convex, smooth, about half length of propodus, defined by 2 robust setae without palm defining corner.

Remarks. The three posterior dorsal carina (pereonite 7, pleonites 1–2), with acute apices distinguish *P. akanthius* sp. nov. from other *Podocerus* species. *Podocerus akanthius* sp. nov. is similar to *P. fulanus* Barnard, 1962 from California which has four acute dorsal carinae. The male gnathopod 2 propodus palm without a distal shelf defines *Podocerus akanthius* sp. nov., and three other Indo-Pacific species, *P. brasiliensis* (Dana, 1853), *P. walkeri* Rabindranath, 1972 and *P. walkeri pedonculata* Ledoyer, 1979. *Podocerus akanthius* sp. nov. has the male gnathopod 2 propodus palm lined with sparse plumose setae, separating in from *P.walkeri* and *P. walkeri pedonculata* which has short robust setae along the palm, while in *P. brasiliensis* the palm has a thick brush of plumose setae.

Distribution. Australia. *New South Wales*. Twofold Bay, Ulladulla, Wattamolla (current study). *Victoria*. Bunurong, Eagles Nest (current study). *Tasmania*. Freycinet Peninsula, Port Arthur (current study). *South Australia*. Flinders Island, Investigator Island Group, Fleurieu Peninsula, Kangaroo Island, Nuyts Archipelago, Ceduna (current study). *Western Australia*. Two Peoples Bay, Cape Peron, King George Sound, Albany, Cape Naturaliste, Cape Riche (current study).

Podocerus dentatus (Haswell, 1879)

Figs 9–12

Cyrtophium dentatum Haswell, 1879: 342, pl. 22, fig. 5.
Dexiocerella dentata.—Haswell, 1885: 109, pl. 17, figs 8–12.
Podocerus dentatus.—Springthorpe & Lowry, 1994:14.—Lowry & Stoddart, 2003: 246.
not *Podocerus cristatus*.—Stebbing, 1906: 706.—Stebbing, 1910: 651.

Type material. Syntypes 3 specimens, AM P3423, Clarke Island, Port Jackson.

Type locality. Clark Island, Port Jackson, New South Wales, Australia

Material examined. *New South Wales*. male, 6.6 mm, dissected, 4 slides, AM P.86162; male, dissected, 5.0 mm, 1 slide, AM P.86166; male, dissected, 5.1 mm, 1 slide, AM P.86165; male, 5.0 mm, 1 slide, AM P.86164; female, 6.6 mm, 1 slide, AM P. 86163, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); many specimens, AM P.77129, Munganno Point, Twofold Bay (37°6'12"S 149°55'42"E), 9 m, subtidal wharf pile, 19 December 1985, coll. S. J. Keable and S. J. Perry (M 6–9); 12 specimens, AM P.77136, southern end of Lighthouse Reef, Ulladulla (35°22'8"S 150°29'18"E), 15 m, hydrozoan on underside of boulder, 30 April 1997, coll. P. B. Berents (NSW 1264); 3 specimens, AM P.77139, southern end of Lighthouse Reef, Ulladulla (35°22'8"S 150°29'18"E), 17.2 m, kelp *Ecklonia* sp. holdfast, 30 April 1997, coll. A. Murray (NSW 1268); 6 specimens, AM P.77167, Halfway Reef, 200 m south of Sullivan Reef, Ulladulla (35°21'25"S 150°29'18"E), 13 m, brown wiry alga on rock ledge, 3 May 1997, coll. A. Murray (NSW 1305); 9 specimens, AM P.77185, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 21 m, low tufting brown and coralline algae, 7 May 1997, coll. A. Murray (NSW 1351); 11 specimens, AM P.77189, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 22 m, red alga, 7 May 1997, coll. A. Murray (NSW 1356); 3 specimens, AM P.77180, northern side of Bannister Head, north of Batemans Bay (35°19'9"S 150°29'7"E), 18 m, algal turf with fine red algae on top of rock, 6 May 1997, coll. K. B. Attwood and R. Springthorpe (NSW 1345); 6 specimens, AM P.77233, north of Broulee Island, south of Batemans Bay (35°51'20"S 150°11'38"E), 16 m, red macroalga *Phacelocarpus pepperocarpos*, 30 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 2017); many specimens, AM P.77237, northwest side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 12 m, kelp *Ecklonia radiata* gutters, 9 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2026); 2 specimens, AM P.77248, west side of Wasp Island, north of Batemans Bay (35°40'2"S 150°18'29"E), 16 m, red macroalga *Curdiea crassa* gutters, date,coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2043); 1 specimen, AM P.77239, northwest side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 16.9 m, green alga *Caulerpa flexilis* gutters, 9 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2027); 2 specimens, AM P.77254, west side of North Tollgate Island, Batemans Bay (35°44'55"S 150°15'27"E), 9 m, green alga *Caulerpa cactoides* gutters, 11 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2052); 2 specimens, AM P.77225, northwest side of Tollgate Islands, Batemans Bay (35°44'49"S 150°15'31"E), 7.9 m, brown macroalga *Colpomenia sinnuosa*, 28 October 2002, coll. G. D. F. Wilson and A. J. Millar (NSW 2002); 1 specimen, AM P.77234, west side of North Tollgate Island, Batemans Bay (35°44'55"S 150°15'27"E), 11 m, mixed algae, 8 February 2003, coll. P. B. Berents, J. Eu and G. D. Wilson (NSW 2024); 9 specimens, AM P.77217, gutters north of Burrewarra Point, south of Batemans Bay (35°49'49"S 150°14'1"E), 24 m, branching hydroid, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1995); 4 specimens, AM P.77212, south of Broulee Island, south of Batemans Bay (35°50'49"S 150°11'5"E), 8 m, from red macroalga branching corallines *Amphiora anceps* and *Jania natalensis*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1989); 2 specimens, AM P.77211, south of Broulee Island, south of Batemans Bay (35°50'49"S 150°11'5"E), 8 m, brown macroalga *Cladostephus spongiosus*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1988); many specimens, AM P.77222, gutters, north of Burrewarra Point, south of Batemans Bay (35°49'52"S 150°14'5"E), 23 m, from red macroalga *Martensia australis*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1999); 2 specimens, AM P.77229, north of Jimmies Island, Batemans Bay (35°48'56"S 150°14'6"E), 16 m, brown macroalga *Dictyota dichotoma*, 29 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 2010); 2 specimens, AM P.35996, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), 1.5 m, subtidal rock platform, 9 October 1984, coll. J. van der Velde (Q3); 1 specimens, AM P.53943, Jervis Bay (35°03'S 150°44'E), 17 m, sponge scallop beds, 13 August 1981, coll. P. B. Berents; many specimens, AM P.86565, west side of North Tollgate Island, Batemans Bay (35°44'50"S 150°15'28"E),16.6 m, red calcareous alga *Dichotomaria marginata,* scattered low reefs, rocks and sand, 8 February 2003, coll. P. B. Berents, J. Eu, A. Millar and G. D. F. Wilson, RV *Baragula* (NSW 2023); 7 specimens, AM 86155, northwest side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 12 m, red alga *Pterocladiella capillacea*, 8 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. Wilson (NSW 2025); 1 specimen, AM P.86156, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 18 m, sponge and gorgonacean, 1 May 1997, coll. K. B. Attwood (NSW 1286); many specimens, AM P.86157, gutters north of Burrewarra Point, south of Batemans Bay (35°49'49"S 150°14'1"E), 24 m, red macroalga *Pachymenia prostrata*, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1996); many specimens, AM P.86158, south of Broulee Island, south of Batemans Bay (35°50'49"S 150°11'5"E), 8 m, brown macroalga *Zonaria diesingiana*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1991); 2 specimens, AM P.86159, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 17 m, bryozoan *Margaretta barbata* on wall,1 May 1997, coll. P. B. Berents (NSW 1280); 3 specimens, AM P.86160, Jolong Reef, approximately 700 metres north east of Cape Banks (33°59'48.1"S 151°15'13.6"E) 20.5 m, mixed alga, 21 July 2009, coll. M. Capa, K. B. Attwood, P. Hutchings, R. Springthorpe, RV Baragula (MI NSW 3646); many specimens, AM P.86090, Bass Point (34°36'S 150°54'E), 35–40 m, 1 February 1990, coll. The Ecology Lab for RMI/Pioneer Project (S1R1).—*Tasmania*: 6 specimens, AM P.83749, Off Hannant's Bight, Cape Sorell (42°11'30"S 145°11'18"E), 16 m, red algae with epiphytic algae, Bryozoa and sponges, 27 April 1991, coll. R. T. Springthorpe and P. M. Berents RV *Flying Scud* (Tas 289);1 specimen, AM P.83729, St Helens Rocks (41°17'30"S 148°22'E), 10 m, macroalgae *Ecklonia* sp. holdfasts, 13 April 1991, coll. R. Springthorpe and C. McCormick (Tas 113); many specimens, AM P.83730, St Helens Rocks (41°17'30"S 148°22'E), 15 m, bryozoan, 13 April 1991, coll. R. Springthorpe and C. McCormick (Tas 115); many specimens, AM P.83731, St Helens Rocks (41°17'30"S 148°22'E), 15 m, mixed algae and bryozoans, 13 April 1991, coll. R. Springthorpe and C. McCormick (Tas 121); 4 specimens, AM P.83732, Elephant Rock, north of St. Helens Point, (41°17'30"S 148°20'E), 20 m, encrusting sponges on rocks among brown macroalgae *Ecklonia* sp. and *Cystophora* sp. kelp, 14 April 1991, coll. R. Springthorpe and C. McCormick (Tas 129); many specimens, AM P.83733, Elephant Rock, north of St Helens Point (41°17'30"S 148°20'E), 20 m, bryozoans, 14 April 1991, coll. R. Springthorpe and C. McCormick (Tas 130); 3 specimens, AM P.83734, Elephant Rock, north of St Helens Point (41°17'30"S 148°20'E), 20 m, red algae, 14 April 1991, coll. R. Springthorpe and C. McCormick (Tas 132); 10 specimens, AM P.83736, Elephant Rock, north of St Helens Point (41°17'30"S 148°20'E), 20 m, 14 April 1991, coll. R. Springthorpe and C. McCormick (Tas 138); many specimens, AM P.83737, Sloop Reef, Bay of Fires (41°13'S 148°17'30"E), 23 m, yellow finger sponge and bryozoan *Iodictyum* sp. (ID: P. S. R. Nair), rocky bottom, 15 April 1991, coll. R. Springthorpe and C. McCormick (Tas 152); 2 specimens, AM P.83738, Sloop Reef, Bay of Fires (41°13'S 148°17'30"E), 23 m, sponges on rocky bottom, 15 April 1991, coll. R. Springthorpe and C. McCormick (Tas 153); 1 specimen, AM P.83739, Sloop Reef, Bay of Fires (41°13'S 148°17'30"E), 23 m, coarse shelly substrate, 15 April 1991, coll. R. Springthorpe and C. McCormick (Tas 154); 8 specimens, AM P.83740, Sloop Reef, Bay of Fires (41°13'S 148°17'30"E), 23 m, on gorgonian fan, 15 April 1991, coll. R. Springthorpe and C. McCormick (Tas 157); 6 specimens, AM P.83741, Sloop Reef, Bay of Fires (41°13'S 148°17'30"E), 23 m, flat orange sponge, 15 April 1991, coll. R. Springthorpe and C. McCormick (Tas 157); 2 specimens, AM P.83750, 100 m north of Fleurieu Point, Freycinet Peninsula (42°10'S 148°15'E), 9 m, boulders, airlift, 30 April 1991, coll. S. J. Keable and R. T. Springthorpe, MV *Flying Scud* (Tas 321); 6 specimens, AM

P.83751, 450 m off Weatherhead, Freycinet Peninsula (42°14'S 148°14'41"E), 15 m, overnight baited trap, 30 April to1 May 1991, coll. J. K. Lowry and S. J. Keable, MV *Flying Scud* (Tas 341); 5 specimens, AM P.83742, north side of Esperance Point, D'Entrecasteaux Channel (43°19'30"S 147°05' 30"E), 1.5 m, coralline alga, 18 April 1991, coll. P. B. Berents (Tas 177); 1 specimen, AM P.83743, north side of Esperance Point, D'Entrecasteaux Channel (43°19'30"S 147°05'30"E), 14 m, red algae, sponges and green algae *Caulerpa* sp., 18 April 1991, coll. Australian Museum Party (Tas 179); 6 specimens, AM P.83745, north side of Esperance Point, D'Entrecasteaux Channel (43°19'30"S 147°05'30"E), 12–14 m, mixed red algae, 18 April 1991, coll. S. J. Keable, J. K. Lowry and R. T. Springthorpe, MV *Flying Scud* (Tas 184); 5 specimens, AM P.83752, north side of Esperance Point, D'Entrecasteaux Channel (43°19'30"S 147°05'30"E), 14 m, mixed red algae, sponges and green algae *Caulerpa* sp., 18 April 1991, coll. S. J. Keable, J. K. Lowry and R. T. Springthorpe, MV *Flying Scud* (Tas 179); 6 specimens, AM P.83746, Cemetery Bluff, Adventure Bay, Bruny Island (43°20'S 147°19'30"E), 15 m, red algae with epiphytic Bryozoa, 23 April 1991, coll. R. T. Springthorpe and P. M. Berents, MV *Flying Scud* (Tas 250); 1 specimen, AM P.83747, Cemetery Bluff, Adventure Bay, Bruny Island (43°20'S 147°19'30"E), 15 m, Bryozoa, 23 April 1991, coll. R. T. Springthorpe and P. M. Berents, MV *Flying Scud* (Tas 251); 1 specimen, AM P.83748, Cemetery Bluff, Adventure Bay, Bruny Island (43°20'S 147°19'30"E), 15 m, red algae, 23 April 1991, coll. R. T. Springthorpe and P. M. Berents, MV *Flying Scud* (Tas 253); 1 "a" male specimen, dissected, 4 slides, 1 "b" male, dissected, 1 slide, 1 "c" female, dissected, 1 slide, SAMA C6556, first bay north of Cape Peron, Maria Island (42°44'35"S 147°00'53"E), 5–10 m, in bryozoan on rocks, in crevices, 5 August 1991, coll. K. L. Gowlett-Holmes and G. Myors; many specimens, SAMA C6556, first bay north of Cape Peron, Maria Island (42°44'35"S 147°00'53"E), 5–10 m, in bryozoan on rocks, in crevices, 5 August 1991, coll. K. L. Gowlett-Holmes and G. Myors; 8 specimens, SAMA C6554, north side of Lagoon Bay, Forestier Peninsula (42°52'12"S 147°55'48"E), 4–9 m, in bryozoan in crevices, 29 July 1991, coll. K. L. Gowlett-Holmes and G. Myors; 1 specimen, SAMA C6555, north side of Lagoon Bay, Forestier Peninsula (42°52'12"S 147°55'48"E), 4–9 m, in algae, 29 July 1991, coll. K. L. Gowlett-Holmes and G. Myors; 3 specimens, SAMA C6550, north side of Lagoon Bay, Forestier Peninsula (42°52'12"S 147°55'48"E), 4–9 m, in bryozoan, 29 July 1991, coll. K. L. Gowlett-Holmes and G. Myors; 1 specimen, SAMA C6549, Cathedral Cave, Waterfall Bay, Tasman Peninsula (43° 3'35"S 147° 56"59"E), 16–18 m, on red algae and hydroids, 21 March 2004, coll. W. Zeidler and K. L. Gowlett-Holmes.—*South Australia*. 1 a male, dissected, 7.0 mm, 1 slide, 2 female specimens, SAMA C6568, "Freds", Snug Cove, Western River, Kangaroo Island (35°41'S 136°50'E), 8–10 m, tunicate *Pyura gibbosa* on reef, 17 February 2000, coll. K. L. Gowlett-Holmes; 1 specimen, SAMA C6599, western side of Cape D'Estaing, Kangaroo Island (35°34'S 137°29'E), 10–15 m, reef, crevices, rubble, 27 January 1989, coll. W. Zeidler and K. Gowlett-Holmes; 1 specimen, SAMA C6567, north side of Point Ellen reef, Vivonne Bay, Kangaroo Island (35°59'S 137°12'E), 3–8 m, boulders, sand, 26 January 1989, W. Zeidler and K. L. Gowlett-Holmes; 1 specimen, SAMA C6570, Rapid Bay, Fleurieu Peninsula (35°31'S 138°10'E), 9 m, pylons, 29 November 1977, coll. M. Keough; 1 specimen, SAMA C6566, north point of Tumby Island, Eyre Peninsula (34°24'23"S 136°08'18"E), 1–3 m, low reef, seagrass, 16 February 1988, coll. W. Zeidler and K. L. Gowlett-Holmes; 2 specimens, SAMA C6594, Victor Harbour, Fleurieu Peninsula (35°30'36"S 138°36'17"E), 6 m, mixed brown fucoid macroalgae, February 2002, coll. A. Hirst, SARDI Encounter Expedition 2002; 1 specimens, NMV J57131, northeastern side of Topgallant Island, Investigator Island Group (33°43"00'S 134°36"36'E), 12.0 m, 21 April 1985 (SA 78); 1 specimen, NMV J62397, northeastern side of Topgallant Island, Investigator Island Group (33°43"00'S 134°36"36'E), 16 m, 22 April 1985 (SA 84).—*Western Australia*. 4 specimens, AM P.79843, off Possession Point, near Mistaken Island, King George Sound (35°2'S 117°55'E), 7 m, mixed sponges and algae, 14 December 1983, coll. J. K. Lowry (WA 135); 1 male, dissected, 1 slide, NMV J62398, eastern end of Thistle Cove, Recherche Archipelago (34°00'00"S 122°12'00"E), 8 m, 11 April 1984 (SWA-28); 4 specimens, NMV J62399, eastern end of Thistle Cove, Recherche Archipelago (34°00'00"S 122°12'00"E), 8 m, 11 April 1984 (SWA-28).

Diagnosis. *Head* with weak hump. *Gnathopod 1* propodus with 8 robust setae near corner of palm. *Gnathopod 2* propodus elongate, propodus palm acute, straight, with broad, well developed distal shelf, shelf margin strongly crenulated, palm with 1 distal subtriangular tooth, without palm defining corner or robust setae. *Pereonites 3-5* dorsal carina produced posteriorly, subtriangular, apically subacute, lateral projections present. *Pereonite 6* dorsal carina produced anteriorly, subtriangular, apically subacute, lateral projections present. *Pereonite 7* dorsal carina produced posteriorly, subtriangular, apically rounded, lateral projections present. *Pleonite 1* dorsal carina produced evenly, rounded, lateral projections present; *Uropod 2* ventromedial spine as long as broad. *Uropod 3* rami with row of slender setae.

Female. *Gnathopod 1* carpus rectolinear, 2.2 times as long as broad; propodus subtriangular, 1.9 times as long as broad, palm straight, defined by corner with 5 robust setae. *Gnathopod 2* merus with 4 robust setae; propodus subovate, 1.6 times as long as broad, palm convex, palm defining corner with tooth and 2 robust setae.

Description. Based on male, 6.6 mm, AM P.86162. *Body* cuticle dorsally processiferous, with mainly posterior dorsal carina. *Head* with weak hump; *eyes* greatly bulging; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Antenna 1* between 0.8 times body length; peduncle article 2 longer than article 3; primary flagellum 0.7 times peduncle length, with 7 articles; accessory flagellum 1-articulate, 5 times as long as broad. *Antenna 2* subequal in length to antenna 1; article 4 shorter than article 5; flagellum 0.4 times peduncle length, posterior margin with robust setae, with 4 articles. *Mandible* accessory setal row with 3 setae. *Maxilla 1* palp distal margin with 5 robust setae.

Pereonites 1–3 without dorsal carina, lateral and ventral projections absent. *Coxae 1–3* discontiguous, *coxae 4–7* contiguous. *Gnathopod 1* coxa subequal to coxa 2, as broad as long, distoventral corner weakly produced ventrally, corner subacute; basis twice as long as broad, without anterodistal setae; carpus subtriangular, twice as long as broad; propodus subtriangular, twice as long as broad, anterior margin with clusters of long slender setae, palm margin smooth, with 8 robust setae near corner of palm; dactylus posterior margin with 7 serrate teeth, cuticle surface with raised serrations, closing along palm. *Gnathopod 2* basis 1.5 times as long as broad, anterodistal corner with rounded produced lobes, with a few plumose setae; merus posterior margin with narrow produced lobe, as long as broad, apically acute, margin without short robust setae; propodus elongate, subovoid, 1.8 times as long as broad, anterior margin with clusters of short robust setae, propodus palm acute, straight, with broad, well developed distal shelf, shelf margin strongly crenulated, palm with 1 distal subtriangular tooth, without palm defining corner or robust setae; dactylus closing along palm. *Pereonites 3-5* dorsal carina produced posteriorly, subtriangular, apically subacute, lateral projections present. *Pereonite 6* dorsal carina produced anteriorly, subtriangular, apically subacute, lateral projections present.

Pereonite 7 dorsal carina produced posteriorly, subtriangular, apically rounded, lateral projections present.

Pleonite 1 dorsal carina produced evenly, rounded, lateral projections present; *epimeron 1* posteroventral corner rounded. *Pleonite 2* dorsal carina produced evenly, broadly rounded, lateral projections present; *epimeron 2* posteroventral corner rounded to subquadrate. *Epimeron 3* posteroventral corner subquadrate. *Urosome* with 3 pairs of uropods. *Urosomite 1* short, twice as long as broad. *Uropod 1* peduncle 3.5 times as long as broad, with well developed ventromedial spine 4 times as long as broad; inner ramus subequal to peduncle length, outer ramus about ¾ length of inner ramus. *Uropod 2* well developed, biramus; ventromedial spine as long as broad; outer ramus about half

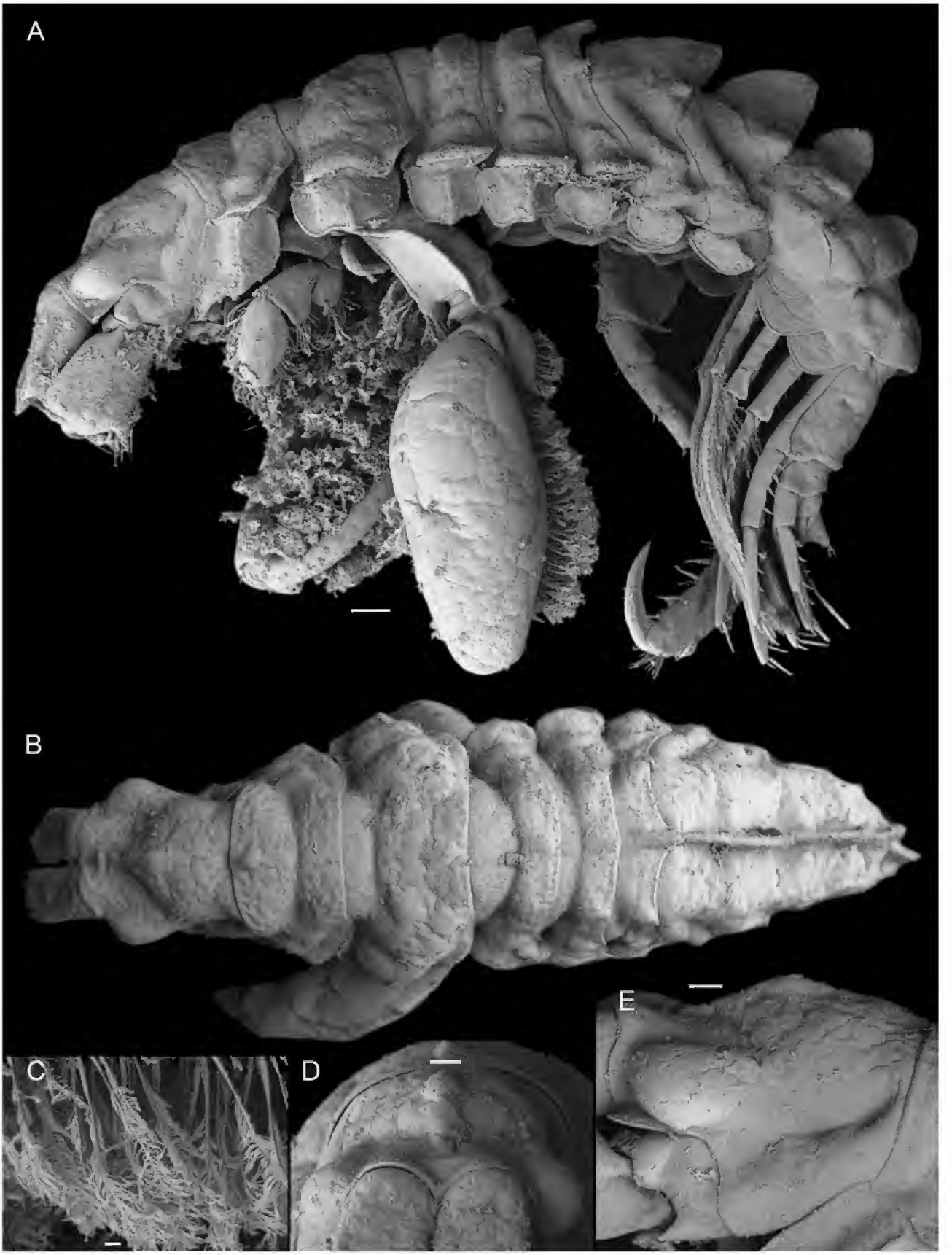

Figure 9. *Podocerus dentatus* (Haswell, 1879) male specimen, AM P.78205, Batemans Bay, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 200 µm); *(C)* gnathopod 2 propodus palm plumose setae (scale 20 µm); *(D)* head frontal view (scale 100 µm); and *(E)* head lateral view (scale 100 µm).

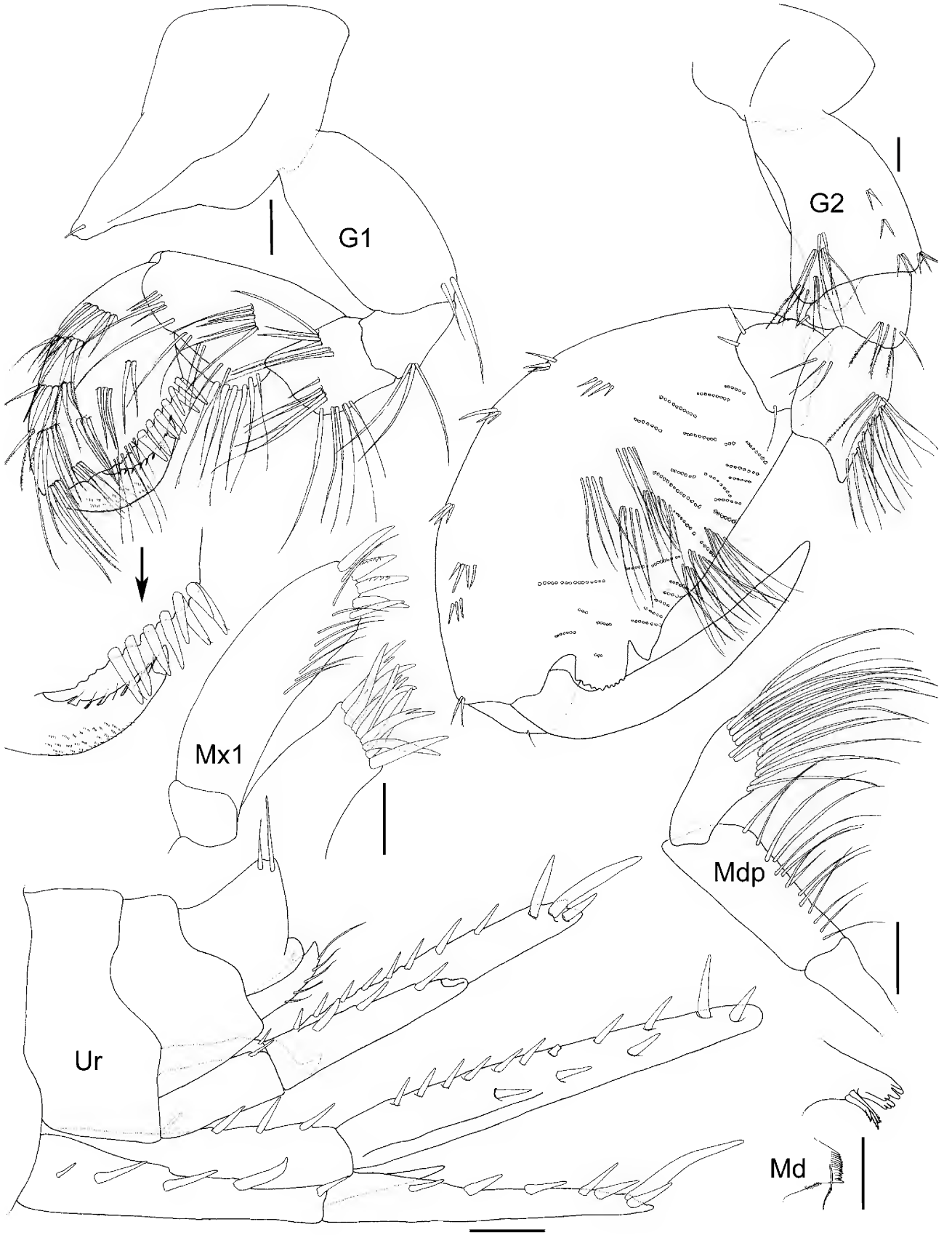

Figure 10. *Podocerus dentatus* (Haswell, 1879) male, AM P.86162, 6.6 mm, Batemans Bay, New South Wales (scales represent 0.1 mm).

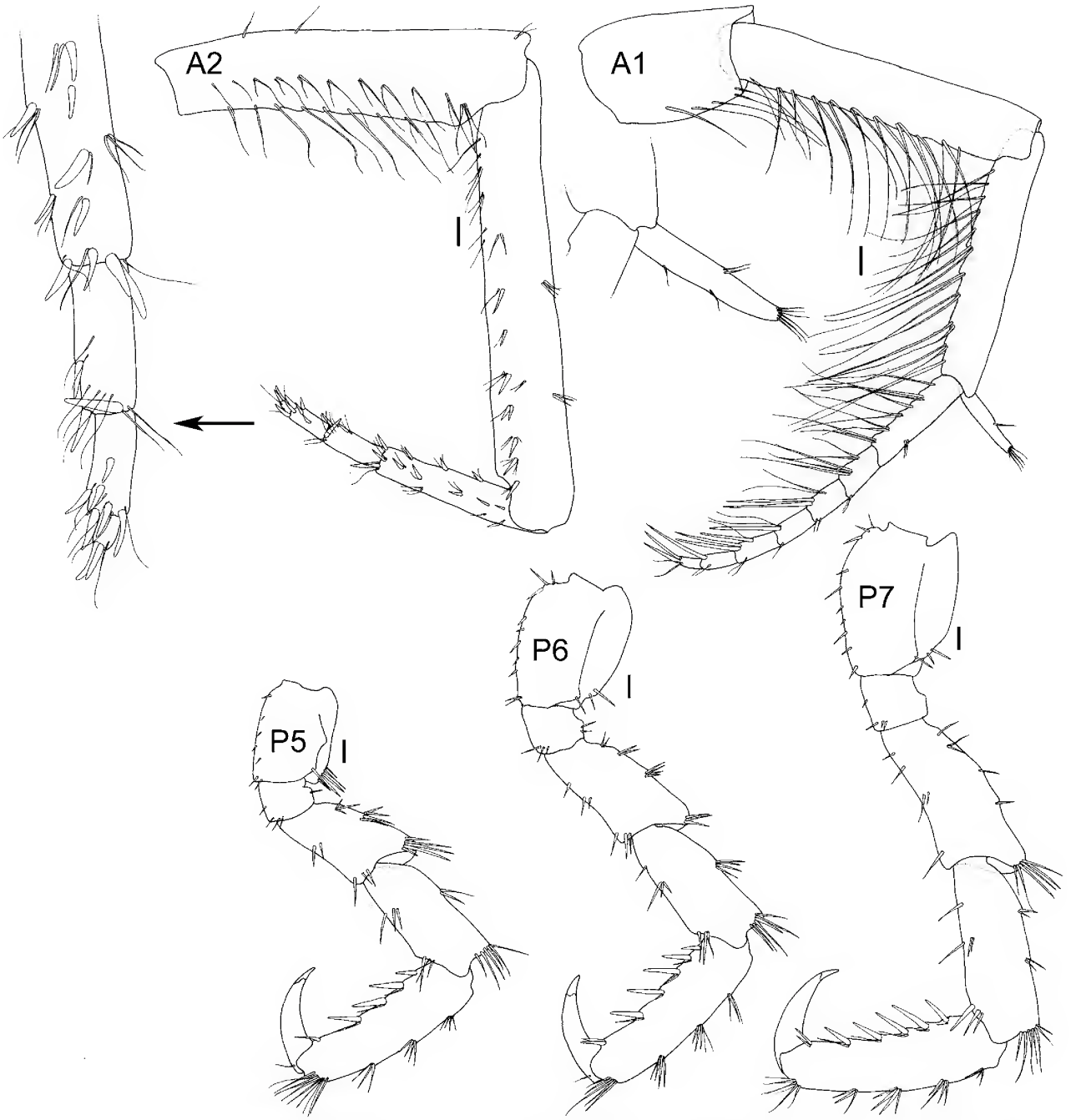

Figure 11. *Podocerus dentatus* (Haswell, 1879) male AM P.86162, 6.6 mm, Batemans Bay, New South Wales (scales represent 0.1 mm).

the length of inner ramus. *Uropod 3* uniramus; rami with row of slender setae. *Telson* dorsal lobe with 2 apical setae; lower margin without lateral or apical setae.

Female (sexually dimorphic characters) based on 1 b female, AM P. 86163. *Gnathopod 1* basis anterior margin without robust setae; carpus rectolinear, 2.2 times as long as broad; propodus subtriangular, 1.9 times as long as broad, palm straight, defined by corner with 5 robust setae; dactylus with 4 serrate teeth. *Gnathopod 2* basis anterodistal corner rounded, with short robust seta; merus posterior margin lobe broad, 1.1 times as broad as long, apically rounded, with 4 robust setae; propodus subovate, 1.6 times as long as broad, anterior margin with clusters of long slender setae, palm convex, ⅔ length of propodus, palm defining corner with tooth and 2 robust setae.

Variation. Male gnathopod 1 propodus palm robust setae: male 5.0 mm, AM P.86164, 6 robust setae; male 5.1 mm, AM P.86165, 5 robust setae; male 5.1 mm, AM P.86166, 9 robust setae.

Remarks. *Podocerus dentatus*, from Port Jackson, Sydney, was removed from the synonymy of *P. cristatus*, from New Zealand, by Lowry & Stoddart, 2003 based on the assessment of probable Haswell syntypes in the Australian Museum collection. Haswell's syntype series was assessed herein and confirmed as a distinct species. Syntype material is in a fragile condition and therefore specimens from a more recent collection are illustrated and described here.

The carination pattern along the dorsal margin of *P. dentatus* is shared by a group of four species, *P. crenulatus*

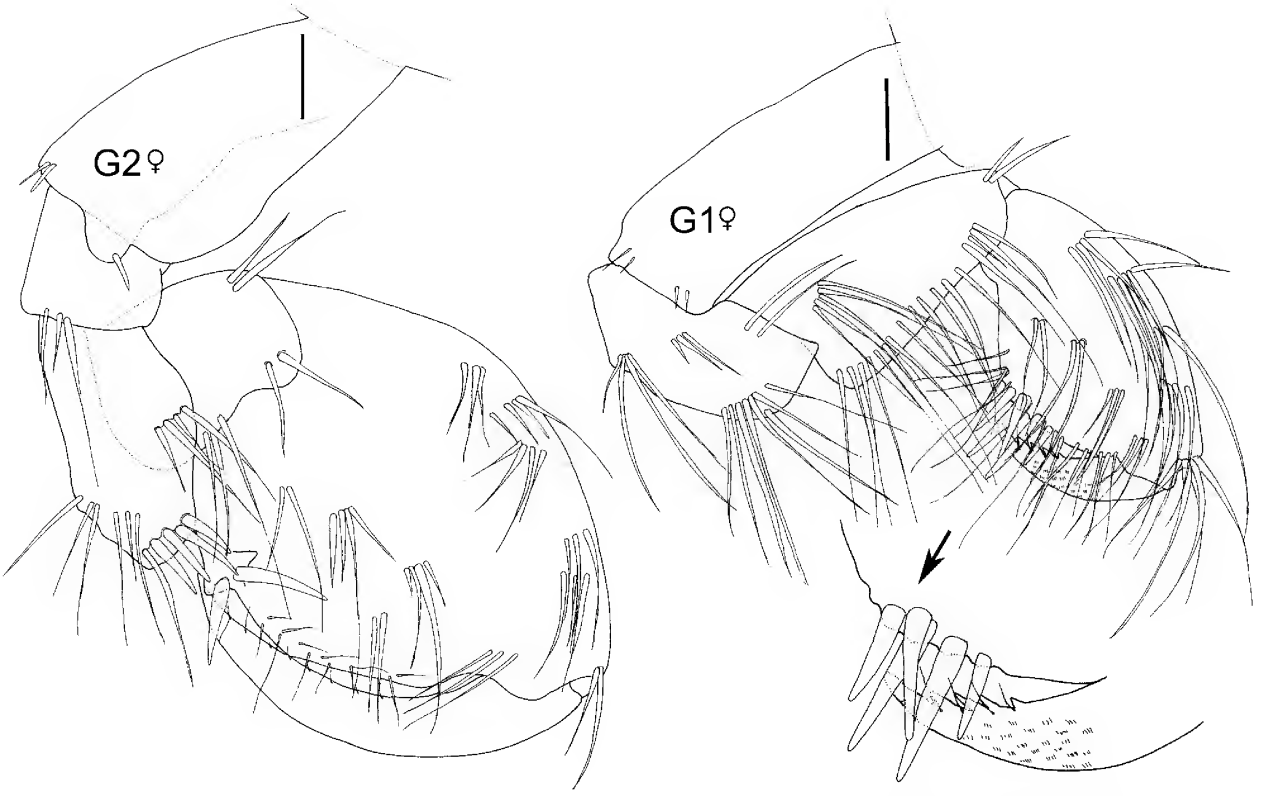

Figure 12. *Podocerus dentatus* (Haswell, 1879) female, AM P.86163, 6.6 mm, Batemans Bay, New South Wales (scales represent 0.1 mm).

Myers, 1985; *P. cristatus* (Thomson, 1879) *sensu stricto* and of Barnard, 1965 (from California); *P. kleidus* Thomas & Barnard, 1992 and *P. vulgaris* sp. nov.

Podocerus kleidus has a smooth head while other species in this group have a weak to well developed head bump. *Podocerus dentatus* can be separated from *P. crenulatus* by the uncrenulated male gnathopod 2 propodus palm margin.

Podocerus dentatus is most similar to, and sympatric with, *P. vulgaris* sp. nov. In *P. dentatus* the dorsal head bump is weakly developed, the male gnathopod 1 propodus palm has between 5–9 defining robust setae and gnathopod 2 propodus palm has 1 tooth, where *P. vulagaris* sp. nov. has a well developed head bump, gnathopod 1 and 2 propodus palm with no robust setae and 2 teeth, respectively.

It is difficult to assess the relationship of *P. dentatus* to *P. cristatus*. A recent search for the whereabouts of Thomson's types could not locate material (Portobello Marine Laboratory and Otago Museum, New Zealand). Material figured by Chilton 1926, fig. 2, from Cooks Strait, New Zealand, attributed to *P. cristatus* is clearly an undescribed species. New material of *P. cristatus* from New Zealand is required to better compare it to other species. Presently *P. cristatus* can be differentiated from *P. dentatus* by the male gnathopod 2 elongate basis and propodus.

Distribution. Australia. *New South Wales*. Clarke Island (Haswell, 1879), Bass Point, Ulladulla, Batemans Bay, Twofold Bay (current study). *Tasmania*. Cape Sorrel, St Helen's Rock, Bay of Fires, Freycinet Peninsula, Maria Island, Bruny Island, D'Entrecasteaux Channel, Forestier Peninsula, Tasman Peninsula (current study). *South Australia*. Fleurieu Peninsula, Kangaroo Island, Eyre Peninsula, Investigator Islands (current study). *Western Australia*. King George Sound, Recherche Archipelago (current study).

Podocerus hystrix Stebbing, 1910

Fig. 13–14

Podocerus hystrix Stebbing, 1910: 622, pl. 58.—Springthorpe & Lowry, 1994:19–20.—Lowry & Stoddart, 2003: 246.—Griffiths, 1974: 322–323.

Type material. Syntypes 10 specimens, AM P.2535; 8 specimens, AM P.2536; 15 specimens, AM P.2537; 15 specimens, AM P.2538; 11 specimens, AM P.2539, various localities.

Type locality. 8 km east of Manning River (*Thetis* station 28); 2.5 km east of Port Hacking, (*Thetis* station 35); 3.5 km east of Botany Bay (*Thetis* station 37); 6 km east of Wattamolla (*Thetis* station 57), New South Wales, Australia.

Material examined. *New South Wales*: 1 SEM pin mounted specimen, AM P.78218; 1 female, 6.1 mm, dissected, 3 slides, AM P.86215, Wattamolla, east of Bate Bay (34°36'S 150°54'E), 35 m, 3 January 1991, coll. The Ecology Lab for RMI/Pioneer Project (BP 4-213); 1 SEM pin mounted specimen, AM P.78220, Wattamolla, east of Bate Bay (34°6'48"S 151°11'E), 45 m, 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (T3-130); 1 specimen, AM P.77320, Cobblers, Bate Bay (34°7'S 151°10'E), 70 m, 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (T3-135); 1 female specimen, AM P. 86167, off Providential Head, east of North Head, Port Jackson (34°8'S 151°8'30"E), 45 m, 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (W3-79); many specimens, AM P.86083, Bass Point (34°36'S 150°54'E), 45–50 m, 1 February 1990, coll. The Ecology Lab for RMI/Pioneer Project (S1R1); 3 specimens, AM P.86084, Bass Point (34°36'S 150°54'E), 45–50 m, 1 February 1990, coll. The Ecology Lab for RMI/Pioneer Project (S1R1); 2 specimens, AM P.86085, Bass Point (34°36'S 150°54'E), 25–30 m, 1 February 1990, coll. The Ecology Lab for RMI/Pioneer Project (S1R5); 1 specimen, AM P.86086, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 35–40 m, 11 January 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2R1); 1 specimen, AM P.86087, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 45–50 m, 11 January 1990, coll. The Ecology Lab for RMI/Pioneer Project (S1R2); 1 specimen, AM P.86088, off Providential Head,

Wattamolla (34°08'S 151°08'30"E), 45–50 m, January 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2P2); 1 specimen, AM P.86089, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 50 m, 11 January 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2R2 D2A 0.5).—*Tasmania*: 2 specimens, AM P.83639, Cemetery Bluff, Adventure Bay, Bruny Island (43°20'S 147°19'30"E), 15 m, red algae with epiphytic Bryozoa, 23 April 1991, coll. R. Springthorpe and P. M. Berents (Tas 250).

Diagnosis. *Head* with single dorsal carina, apically rounded, recurved, produced anteriorly;

Pereonite 1 with dorsal two carina, first carina subtriangular, apically rounded produced anteriorly and second carina subtriangular, apically subacute, produced dorsally; with two pair of lateral projections, single pair of ventral projections. *Coxae 1–7* contiguous. *Pereonite 2* dorsal carina, produced evenly, subtriangular, apically rounded, with pair of lateral and ventral projections. *Pereonite 3* dorsal carina produced evenly, subtriangular, apically rounded, with lateral and ventral projections. *Pereonite 4* with lateral and ventral projections. *Pereonite 5* dorsal carina produced evenly, subtriangular, apically rounded, with lateral and ventral projections. *Pereonite 6–7* dorsal carina produced posteriorly, subtriangular, apically rounded, with lateral and ventral projection. *Pleonite 1–2* dorsal carina produced evenly, subtriangular, apically rounded, with lateral projections. *Uropod 2* ventromedial spine twice as long as broad. *Telson* dorsal lobe with six apical robust setae.

Description. Based on female, 6.1 mm, AM P.86215. *Body* cuticle processiferous, with dorsal and lateral carina along pereonites and pleonites. *Head* with single dorsal carina, apically rounded, recurved, produced anteriorly; *eyes* extremely bulging; anteroventral corner subquadrate. *Mandible* accessory setal row with 3 setae.

Pereonite 1 with dorsal two carina, first carina subtriangular, apically rounded produced anteriorly and second carina subtriangular, apically subacute, produced dorsally; with two pair of lateral projections, single pair of ventral projections. *Coxae 1–7* contiguous.

Gnathopod 1 coxa smaller than coxa 2, distoventral corner produced anteriorly, corner subacute; basis 2.5 times as long as broad, without anterodistal robust setae; carpus subrectangular, twice as long as broad; propodus subtriangular, twice as long as broad, anterior margin with clusters of long slender setae, palm smooth, without robust setae; dactylus posterior margin with 5 serrate teeth, cuticle surface with raised serrations, closing along palm. *Pereonite 2* dorsal carina, produced evenly, subtriangular, apically rounded, with pair of lateral and ventral projections. *Gnathopod 2* basis 2.2 times as long as broad, anterior distal corner with rounded lobe,with 1 robust seta; merus anterior lobe produced as broad as long, apically rounded with 1 robust seta; propodus subovate, 1.8 times as long as broad, palm smooth, ⅔ length of propodus, slightly convex, without distal shelf, palm defined by corner with 2 robust setae. *Pereonite 3* dorsal carina produced evenly, subtriangular, apically rounded, with lateral and ventral projections. *Pereonite 4* without dorsal carina, with lateral and ventral projections. *Pereonite 5* dorsal carina produced evenly, subtriangular, apically rounded, with lateral and ventral projections. *Pereonite 6–7* dorsal carina produced posteriorly, subtriangular, apically rounded, with lateral and ventral projection.

Pleonite 1 dorsal carina produced evenly, subtriangular, apically rounded, with lateral projections; *epimeron 1* posteroventral corner rounded. *Pleonite 2* dorsal carina produced evenly, subtriangular, apically rounded, with lateral projections; *epimera 2–3* posteroventral corner rounded. *Urosome* with three pairs of uropods. *Urosomite 1* elongate, 3 times as long as broad. *Uropod 1* peduncle 4 times as long as broad, with well developed ventromedial spine twice as long as broad; inner ramus 1.2 times peduncle length, outer ramus slightly shorter than inner ramus. *Uropod 2* well developed, biramus; ventromedial spine twice as long as broad; outer ramus ¾ length of inner ramus. *Uropod 3* uniramus, without apical setae. *Telson* dorsal lobe with six apical robust setae; lower lateral margin with 3 pair of short slender setae.

Remarks. The head with anterior recurved carina readily distinguishes *P. hystrix* from other *Podocerus*.

Distribution. Australia. *New South Wales*. Manning River, Port Hacking, Port Jackson, Bate Bay, Bass Point, Wattamolla (Stebbing, 1910; current study). *Tasmania*. Bruny Island (current study).

Podocerus inconspicuus (Stebbing, 1888)

Figs 15–17

Platophium inconspicuum Stebbing, 1888: 1194, pl. 131.
Podocerus inconspicuus Stebbing, 1906: 702.—Stebbing, 1910: 650.—Lowry & Stoddart, 2003: 246.
not *Podocerus inconspicuus*.—Pirlot, 1938: 28, fig. 160.—Nagata, 1965: 322, fig. 43.

Type locality. Off Port Jackson, New South Wales, Australia.

Material examined. *New South Wales*. male, 5.0 mm. dissected, 2 slides, AM P.86557; female specimen, 5.4 mm, dissected, 1 slide, AM P.86558, off Providential Head, Wattamolla (34°8'S 151°8'30"E), 45 m, 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (W3-79); 1 SEM pin mounted specimen, AM P.78216, off Providential Head, Wattamolla (34°8'S 151°8'30"E), 45 m, 29 October 1990, The Ecology Lab for RMI/Pioneer Project (W3-77); b female, 4.6 mm. dissected, 1 slide, AM P.86210, off Providential Head, Wattamolla (34°8'S 151°8'30"E), 45 m, 29 October 1990, The Ecology Lab for RMI/Pioneer Project (W3-77); 5 specimens, AM P.86559, off Providential Head, Wattamolla (34°8'S 151°8'30"E), 45 m, 29 October 1990, The Ecology Lab for RMI/Pioneer Project (W3-77); 1 specimens, AM P.86560, off Providential Head, Wattamolla (34°8'S 151°8'30"E), 45–50 m, 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (W3-79); male, 4.9 mm. dissected, 2 slides, AM P.86561, 1 Z female specimen, dissected, 1 slide, AM P.86211, 6 female specimens, AM P.86562, off Providential Head, Wattamolla, Bate Bay (34°8'S 151°8'30"E), 45 m, 29 October 1990, The Ecology Lab for RMI/Pioneer Project (W3-77); 2 female specimens, AM P.86174, off Providential Head, Wattamolla, Bate Bay (34°8'S 151°8'30"E), 45 m, 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (T3-79); 1 female specimen, AM P.86170, off Providential Head, Wattamolla, Bate Bay (34°8'S 151°8'30"E), 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (T3-87); 1 female specimen, AM P.86173, off Providential Head, Wattamolla, Bate Bay (34°8'S 151°8'30"E), 29 October 1990, coll. The Ecology Lab for RMI/Pioneer Project (T3-83); 1 juv. male and 2 female specimens, AM P.86172, off Providential Head, Wattamolla, Bate Bay (34°8'S 151°8'30"E), 14 November 1990, coll. The Ecology Lab for RMI/Pioneer Project (T3-81); 1 specimen, AM P.77321, off Providential Head, Wattamolla, Bate Bay (34°8'S 151°8'30"E), 70 m, 29 October 1990, The Ecology Lab for RMI/Pioneer Project (T3-85); 1 specimen, AM P.86171, off Providential Head, Wattamolla, Bate Bay (34°8'S 151°8'30"E), 70 m, 29 October 1990, The Ecology Lab for RMI/Pioneer Project (T3-87); 2 specimens, AM P.86175, Off Providential Head, Wattamolla, (34°8'S 151°8'30"E), 45–50 m, Smith McIntyre grab, coll. The Ecology Lab for Ready Mixed Industries, 29 October to 14 November 1990 (3-83); 1 specimen, AM P.861690, Bass Point, (34°36'S 150°54'E) 35–40 m, Smith McIntyre grab, coll. The Ecology Lab for Ready Mixed Industries, 3 January to 18 January 1991 (BP4-213); 1 specimen, AM P.46600, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 25–30 m, 11 January 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2R3); 3 specimens, AM P.46689, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 35–40 m, 11 January 1990, coll. The

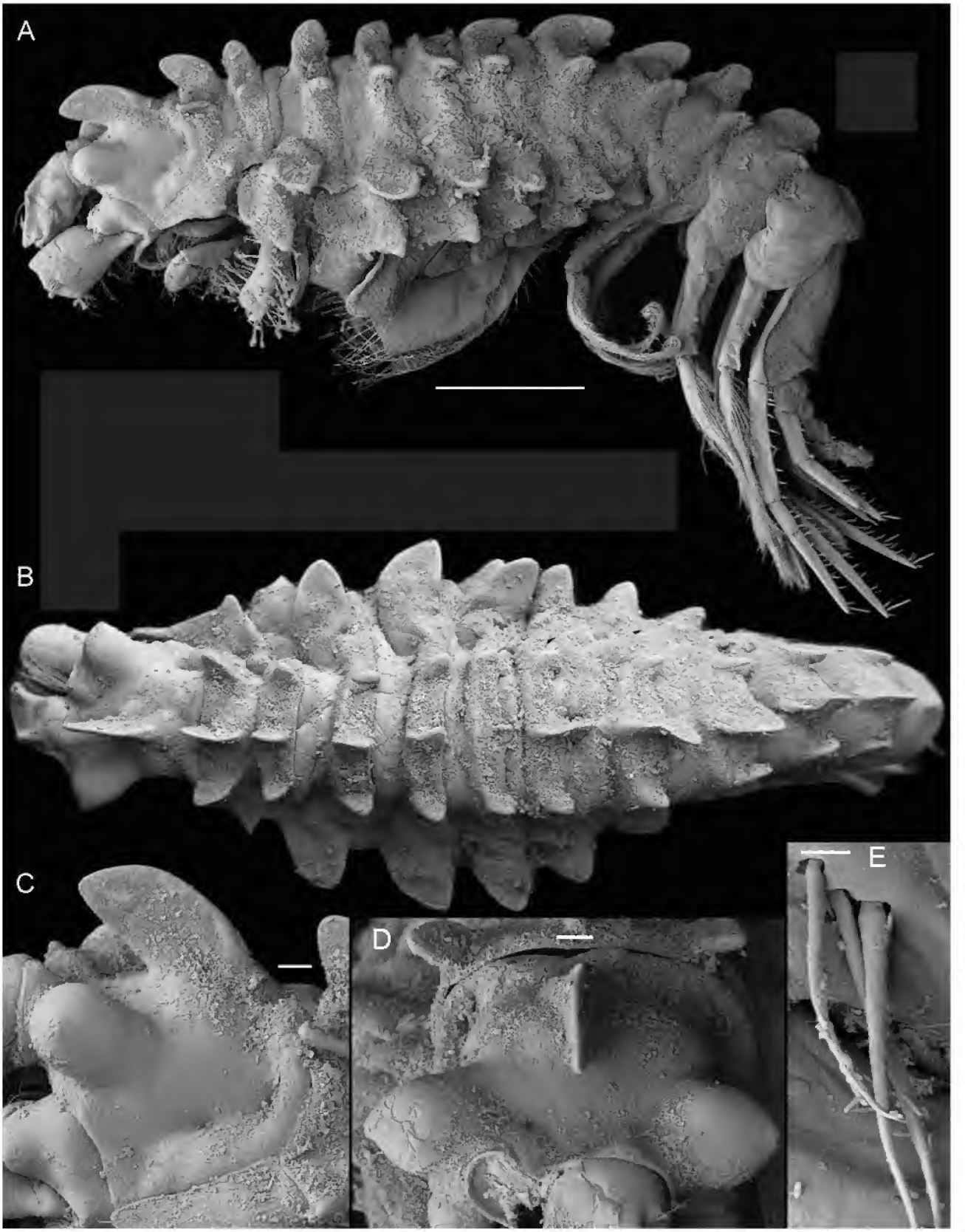

Figure 13. *Podocerus hystrix* Stebbing, 1910 female specimen, AM P.78218, Bate Bay, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 1 mm); *(C)* head lateral view (scale 100 μm); *(D)* head frontal view (scale 100 μm); and *(E)* gnathopod 2 propodus palm plumose setae (scale 20 μm).

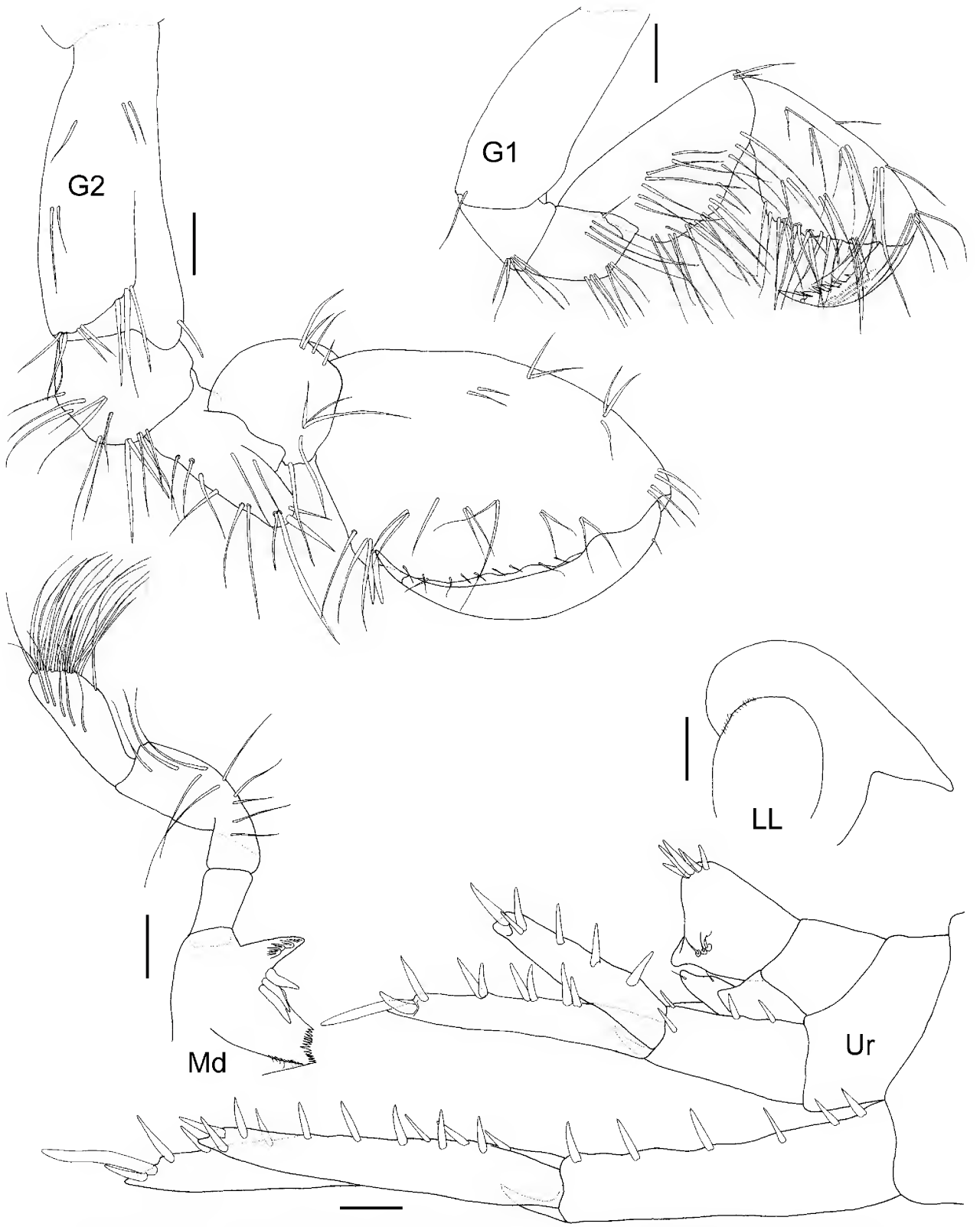

Figure 14. *Podocerus hystrix* Stebbing, 1910 female, AM P.86215, 6.1 mm, Bate Bay (scales represent 0.1 mm).

Ecology Lab for RMI/Pioneer Project (S2R1); 1 specimen, AM P.52931, Bass Point (34°36'S 150°54'E), 25–30 m, Jun 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2R3); 2 specimens, AM P.86075, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 50 m, 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2R1 Deep); 2 specimens, AM P.86077, Bass Point (34°36'S 150°54'E), 45–50 m, 01 February 1990, coll. The Ecology Lab for RMI/Pioneer Project (S1R3); 2 specimens, AM P.86078, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 45–50 m, 11 January 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2R4); 1 specimen, AM P.86079, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 35–40 m, 11 January 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2P3); 2 specimens, AM P.86080, Bass Point (34°36'S 150°54'E), 35–40 m, 1 February 1990, coll. The Ecology Lab for RMI/Pioneer Project (S2R1); many, AM P.86081, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 45–50 m, 11 January 1990, coll. The Ecology Lab for RMI/Pioneer Project (S1R2); many, AM P.86082, Bass

Point (34°36'S 150°54'E), 45–50 m, 1 February 1990, coll. The Ecology Lab for RMI/Pioneer Project (S1R1); 2 specimens, AM P.86076, off Providential Head, Wattamolla (34°08'S 151°08'30"E), 35–40 m, 11 January 1990, coll. The Ecology Lab for RMI/Pioneer Project; 1 specimen, AM P.86091, south east of Bermagui (36°26'S 150°14'06"E), 122 m, 5 Sep 1994, coll. FRV *Southern Surveyor* (SS05/94/155).

Diagnosis. *Pereonite 1* dorsal carina produced dorsally as two well developed humps, lateral and ventral projections absent. *Pereonite 2* dorsal carina produced evenly, subtriangular, apically rounded. *Gnathopod 1* propodus subtriangular with 5 robust setae near corner of palm. *Gnathopod 2* propodus subovoid elongate, palm acute, concave, with one distal subquadrate tooth and a small palm defining tooth, without palm defining setae. *Pereonite 3* dorsal carina produced posteriorly, subtriangular, apically rounded, lateral projections present. *Pereonites 4–7* dorsal carina produced posteriorly, subtriangular, apically subacute, lateral projections present.

Pleonites 1–2 dorsal carina subtriangular, produced posteriorly, apically rounded, lateral projections present. *Uropod 2* ventromedial spine as long as broad.

Female *Gnathopod 1* carpus rectolinear, 2.1 times as long as broad; propodus elongate, subtriangular, produced distally, 2.4 times as long as broad. *Gnathopod 2* defined by tooth and 5 robust setae.

Description. Based on male, 5.0 mm. AM P.86557. *Body* cuticle dorsally processiferous, with mainly posterior dorsal carina, without lateral and ventral carina. *Head* with well developed hump; *eyes* greatly bulging; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Mandible* accessory setal row with 3 setae. *Maxilla 1* palp distal margin with 4 robust setae. *Pereonite 1* dorsal carina produced dorsally as two well developed humps, lateral and ventral projections absent. *Pereonite 2* dorsal carina produced evenly, subtriangular, apically rounded. *Coxae 1–3* discontiguous, *coxae 4–7* contiguous. *Gnathopod 1* coxa as broad as long, distoventral corner produced anteriorly, anteroventral corner subacute; basis 3 times as long as broad, with a few long slender anterodistal setae; carpus rectolinear, 2.3 times as long as broad; propodus subtriangular, twice as long as broad, anterior margin with clusters of long slender setae, palm margin smooth, with 5 robust setae near corner of palm; dactylus posterior margin with 5 serrate teeth, cuticle surface smooth, closing along palm. *Gnathopod 2* basis 2.2 times as long as broad, anterodistal corner rounded produced lobes, with short robust setae; merus posterior margin with narrow produced lobe, as long as broad, apically acute; propodus subovoid elongate, 3 times as long as broad, anterior margin with clusters of long slender robust setae, palm acute, concave, ⅔ length of propodus, with broad, well developed distal shelf, shelf margin crenulated, with one distal subquadrate tooth and a small palm defining tooth, without palm defining setae; dactylus closing along palm.

Pereonite 3 dorsal carina produced posteriorly, subtriangular, apically rounded, lateral projections present. *Pereonites 4–7* dorsal carina produced posteriorly, subtriangular, apically subacute, lateral projections present.

Pleonites 1–2 dorsal carina subtriangular, produced posteriorly, apically rounded, lateral projections present; *Epimera 1–3* rounded. *Urosome* with 3 pair of uropods. *Urosomite 1* short, twice as long as broad. *Uropod 1* peduncle elongate, 4 times as long as broad, with well developed ventromedial spine twice as long as broad; inner ramus 1.1 times peduncle length; outer ramus about ¾ length of inner ramus. *Uropod 2* well developed, biramus; ventromedial spine as long as broad; outer ramus about half the length of inner ramus. *Uropod 3* uniramus; rami with 2 apical setae. *Telson* dorsal lobe with 2 apical setae, lower margin without lateral or apical setae.

Female (sexually dimorphic characters) based on female specimen, 5.4 mm, AM P.86558. *Gnathopod 1* basis anterior margin with 3 robust setae; carpus rectolinear, 2.1 times as long as broad; propodus elongate, subtriangular, produced distally, 2.4 times as long as broad, palm with 5 robust setae; dactylus posterior margin with 3 serrate teeth. *Gnathopod 2* basis anterodistal corner rounded, with short robust setae; merus posterior margin broad, as broad as long, apically rounded, with 3 short robust setae; propodus subovate, twice as long as broad, anterior margin with a few long slender setae, palm straight, without distal shelf, defined by tooth and 5 robust setae.

Remarks. This is the first description of a male specimen from near the type locality. The original description of *P. inconspicuus* from a single female specimen has lead to much confusion.

Pirlot 1938 figured male and female specimens attributed to *P. inconspicuus* from Sulawesi. However when compared to the material illustrated here from closer to the type locality, Pirlot's male specimen is less setose along the gnathopod 2 propodus palm and does not have the small posterior proximal tooth. Therefore it appears that the Pirlot material is not *P. inconspicuus*, although a closely related fauna. Pirlot 1938 also placed *P. palinuri* K. H. Barnard 1916 into synonymy with *P. inconspicuus*, however *P. palinuri* is reinstated here as a valid species, due to the variation in the male gnathopod 2 propodus sculpting as outlined in growth stages in K. H. Barnard 1937. Material of *P. inconspicuus* illustrated by Nagata 1965 from Japan does not have sufficient sculpting along the male gnathopod 2 palm and is also remove from synonymy.

Podocerus inconspicuus is similar to *P. oliphant* sp. nov. in the sculpting of the male gnathopod 2 propodus, however the later species has less pronounced lateral carinations and a more developed head bump.

Distribution. Australia. *New South Wales*. Port Jackson, Bate Bay, Bass Point, Wattamolla, Bermagui (Stebbing, 1888; current study).

Podocerus lobatus (Haswell, 1885)

Figs 18–21

Dexiocerella lobata Haswell, 1885: 110, pl. 18, figs 6–8.
Cyrtophium lobatum.—Chevreux and Guerne, 1888: 627.
Platophium l.—Stebbing, 1888: 1184.
Platophium orientale.—Della Valle, 1893: 333.
Podocerus lobatus.—Stebbing, 1899: 239.—Pirlot, 1938: 358, fig. 161.—Springthorpe & Lowry, 1994: 128.—Lowry & Stoddart, 2003: 246.

Type material. Whereabouts unknown, presumed lost (Springthorpe and Lowry, 1994). Neotype, male, 4.2 mm, dissected, 4 slides, AM P.86212, east of South Head, Port Jackson, New South Wales (33°50'S 151°18'E), 23 m, host sponge: *Holopsamma flavus*, February 1973, coll. Australian Museum Shelf Benthic Survey.

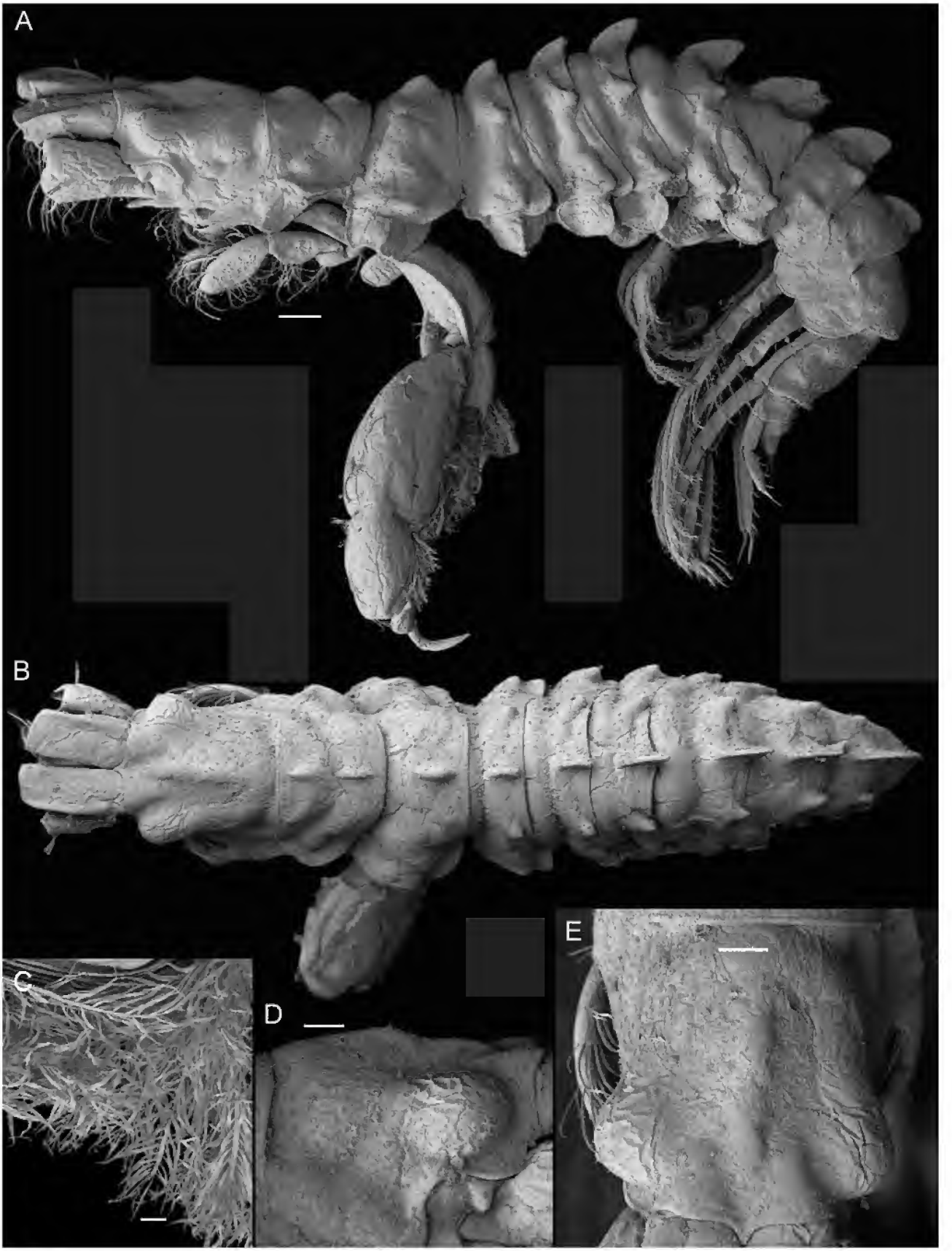

Figure 15. *Podocerus inconspicuus* (Stebbing, 1888) male specimen, AM P.78216, Bate Bay, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 200 µm); *(C)* gnathopod 2 propodus palm plumose setae (scale 20 µm); *(D)* head lateral view (scale 100 µm); *(E)* head dorsal view (scale 100 µm).

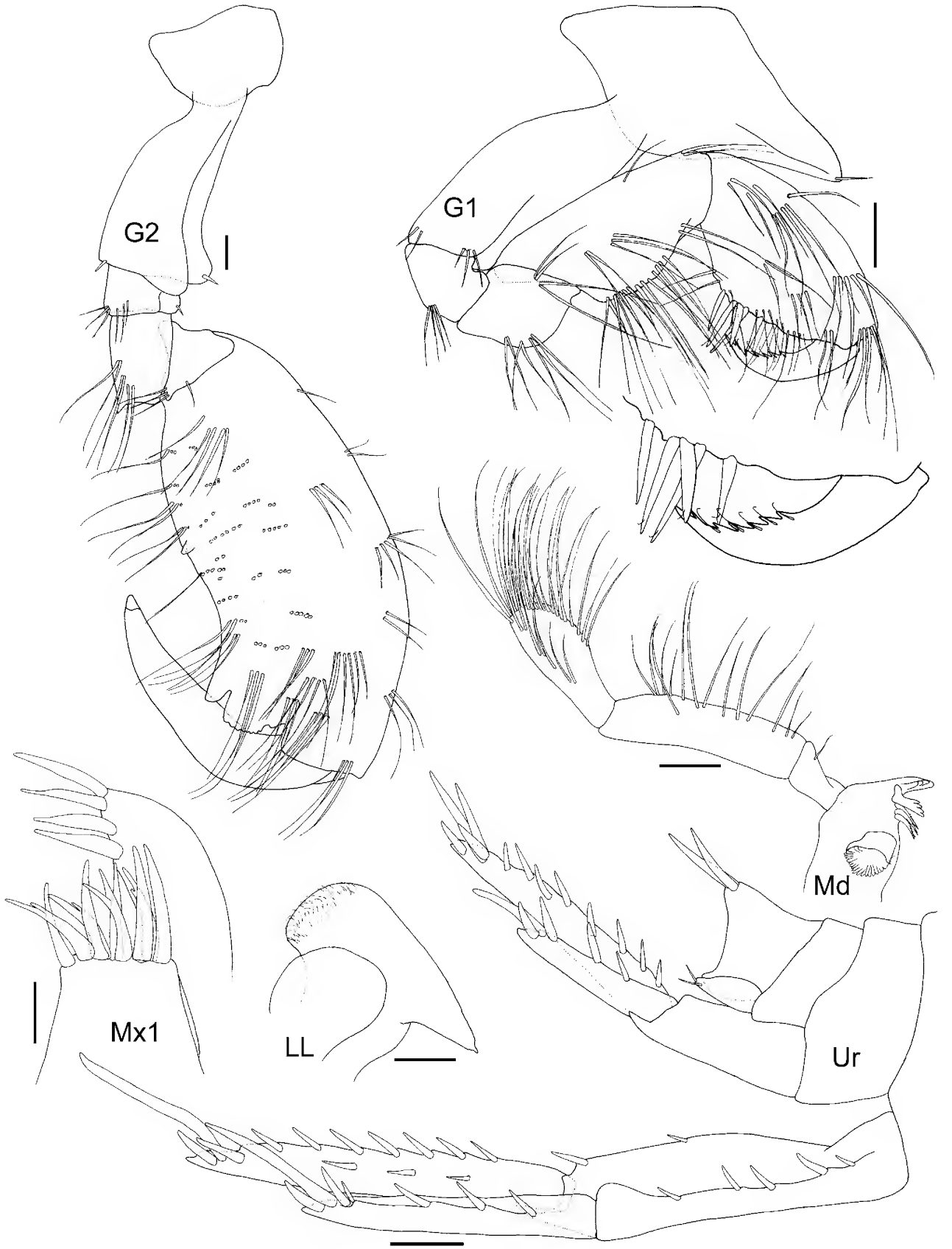

Figure 16. *Podocerus inconspicuus* (Stebbing, 1888) male, AM P.86557, 5.0 mm, Bate Bay, New South Wales (scales represent 0.1 mm).

Figure 17. *Podocerus inconspicuus* (Stebbing, 1888) female, AM P.86558, 5.4 mm, Bate Bay, New South Wales (scales represent 0.1 mm).

Type locality. East of South Head, Port Jackson, New South Wales, Australia (33°50'S 151°18'E).

Additional material examined. *New South Wales*. Male, 3.5 mm, dissected, 1 slide, AM P.86564; 1 female specimen, 4.9 mm, dissected, 1 slide, AM P.86176; 20 specimens, AM P.22276, east of South Head, Port Jackson (33°50'S 151°18'E), 23 m, host sponge: *Holopsamma flavus*, February 1973, coll. Australian Museum Shelf Benthic Survey; 1 SEM pin mounted specimen, AM P.78214, Port Jackson (33°49'S 151°20'E), 25 m, host sponge: *Holopsamma flavus*, February 1973, coll. Australian Museum Shelf Benthic Survey; 1 SEM pin mounted specimen, AM P.78215, Port Jackson (33°49'S 151°20'E), 25 m, host sponge: *Holopsamma flavus*, February 1973, coll. Australian Museum Shelf Benthic Survey; 20 specimens, AM P.22277, east of South Head, Port Jackson (33°50'S 151°18'E), 23 m, host sponge: *Holopsamma flavus*, February 1973, coll. Australian Museum Shelf Benthic Survey; 25 specimens, AM P.22280, east of North Head, Port Jackson (33°49'S 151°20'E), 25 m, host sponge: *Holopsamma flavus*, February 1973, coll. Australian Museum Shelf Benthic Survey; 4 specimens, AM P.77138, southern end of Lighthouse Reef, Ulladulla (35°22'8"S 150°29'18"E), 16 m, bryozoan, 30 April 1997, coll. P. B. Berents and K. B. Attwood (NSW 1267); many specimens, AM P.77152, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 17 m, airlift over rock wall, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1282); 1 a male specimen, 3.5 mm, dissected, 4 slides AM P.86177, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 16 m, bryozoans *Catenicella plagiostoma* and *Orthoscuticella* sp., 1 May 1997, coll. P. B. Berents (NSW 1284); 1 b female specimen, 3.1 mm, dissected, 1 slide, AM P.86178, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 16 m, bryozoans *Catenicella plagiostoma* and *Orthoscuticella* sp., 1 May 1997, coll. P. B. Berents (NSW 1284); many specimens, AM P.77154, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 16 m, bryozoans *Catenicella plagiostoma* and *Orthoscuticella* sp.), 1 May 1997, coll. P. B. Berents (NSW 1284); many specimens, AM P.77158, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 18 m, sponge and gorgonacean, 1 May 1997, coll. K. B. Attwood (NSW 1286); many specimens, AM P.77170, Halfway Reef, 200 m south of Sullivan Reef, Ulladulla (35°21'25"S 150°29'18"E), 12 m, bryozoan under ledge, 3 May 1997, coll. P. B. Berents (NSW 1311); many specimens, AM P.77171, Halfway Reef, 200 m south of Sullivan Reef, Ulladulla (35°21'25"S 150°29'18"E), 12 m, bryozoan under ledge *Margaretta barbata*, 3 May 1997, coll. P. B. Berents (NSW 1315); 7 specimens, AM P.86179, Clovelly Bay, Sydney (33°55.01'S 151°15.98'E), 6 m, brown alga *Sargassum* sp., 16 December 1999, coll. R. Peart and K. Dempsey (syd-13, NSW 1692); 2 specimens, AM P.84129, Clovelly Bay, Sydney (33°55.01'S 151°15.98'E), 6 m, brown alga *Sargassum* sp., 16 December 1999, coll. R. Peart and K. Dempsey (syd-14, NSW 1693); 1 specimen, AM P.86180, Clovelly Bay, Sydney (33°55.01'S 151°15.98'E), 6 m, *Sargassum* sp., 16 December 1999, coll. R. Peart and K. Dempsey (syd-15, NSW 1694); 3 specimens, AM P.86181, Clovelly Bay, Sydney (33°55.01'S 151°15.98'E), 6 m, brown alga, *Sargassum* sp., 16 December 1999, coll. R. Peart and K. Dempsey (syd-17, NSW 1696); 5 specimens, AM P.86182, Clovelly Bay, Sydney (33°55.01'S 151°15.98'E), 6 m, brown alga *Sargassum* sp., 16 December 1999, coll. R. Peart and K. Dempsey, (syd-20, NSW 1699); 1 specimen, AM P.86186, Clovelly Bay, Sydney (33°55.01'S 151°15.98'E), 6 m, brown alga *Padina* sp., 16 December 1999, coll. R. Peart and K. Dempsey (syd-22, NSW 1701); 1 specimen, AM P.86183, Clovelly Bay, Sydney (33°55.01'S 151°15.98'E), 6 m, fine brown weed., coll. R. Peart and K. Dempsey, 19 January 2000 (syd-35, NSW 1714); 2 specimens, AM P.86184, off Harbord Baths, Sydney (33°46.99'S, 151°17.61'E), 5 m, mixed browns and *Dictyota* sp., coll. R. Peart and K. Dempsey, 18 January 2000 (syd-26, NSW 1705); 2 specimens, AM P.86185, off Harbord Baths, Sydney, (33°46.99'S, 151°17.61'E), 5 m, mixed browns and *Sargassum* sp., coll. R. Peart and K. Dempsey, 18 January 2000 (syd-27; NSW 1706).—*Western Australia*. male, 4.0 mm, dissected, 1 slide, AM P.86187, Arthur Head, off end of South Mole, Fremantle (32°3'S 115°44'E), 6 m, orange gorgonacean, 25 December 1983, coll. R. Springthorpe (WA 286); 50+ specimens, AM P.79827 many specimens, Arthur Head, off end of South Mole, Fremantle (32°3'S 115°44'E), 6 m, orange gorgonacean, 25 December 1983, coll. R. Springthorpe (WA 286); 2 specimens, South Mole, Port Harding Torbay, Fremantle (32°3'S 115°44'E), 6 m, spirorbid polychaete tubes, 25 December 1983, coll. J. K. Lowry (WA 283); 1 specimens, NMV J57055, 1 km offshore of Seven Mile Beach, north of Dongara (29°12'00"S 114°53"00'E), 8 m, 27 April 1986 (SWA 100).

Diagnosis. *Head* with weak hump. *Gnathopod 1* propodus subrectangular, without robust setae. *Gnathopod 2* basis 1.1 times as long as broad; propodus subovate, palm subequal in length to propodus, shelf margin strongly crenulate, with one proximal and one distal palm defining tooth, without robust setae. *Pereonites 3–4* dorsal carina narrow, produced evenly. *Pereonite 5* dorsal carina narrow, produced posteriorly. *Pereonites 6–7* dorsal carina broad, produced posteriorly. *Pleonite 1* dorsal carina broad, produced evenly.

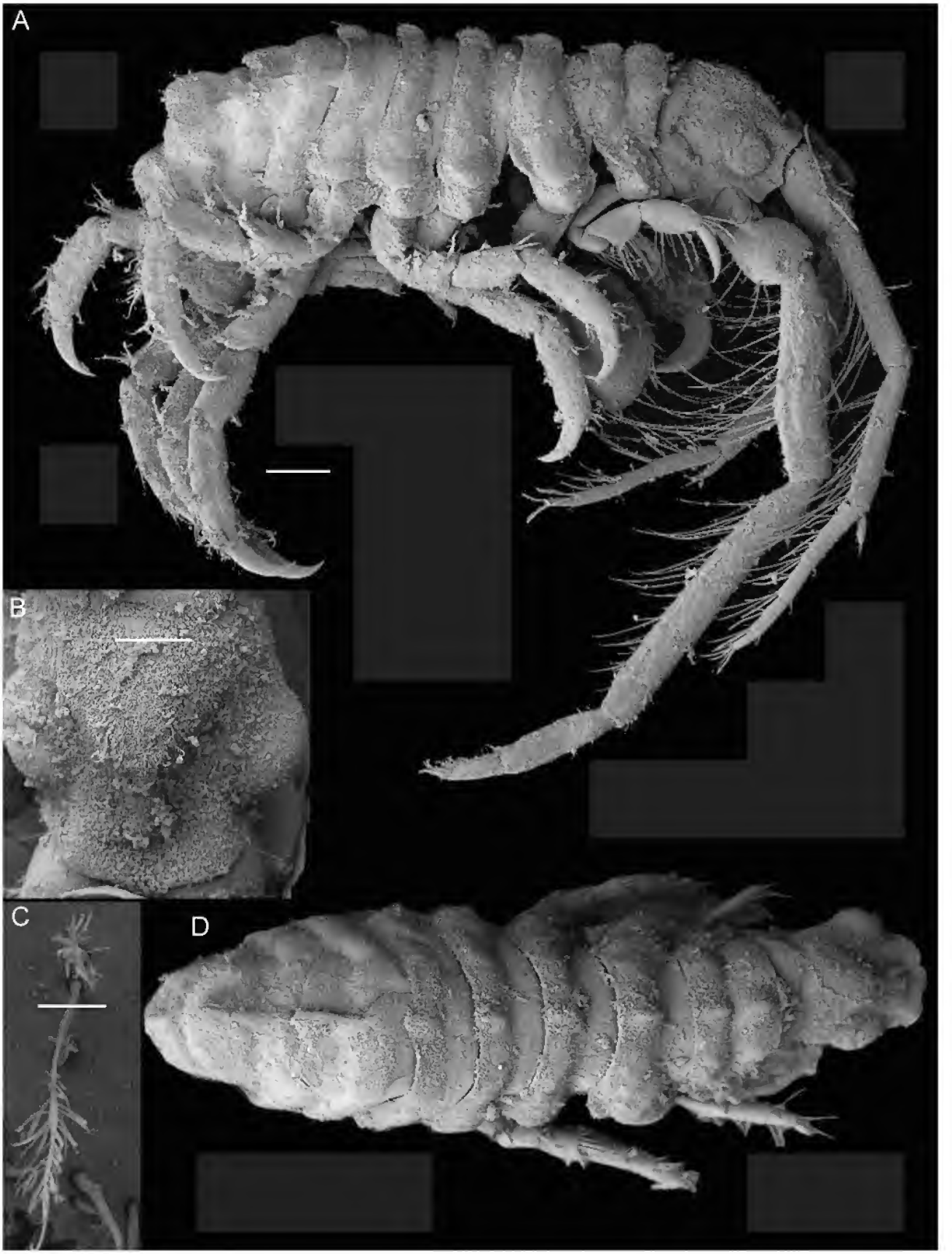

Figure 18. *Podocerus lobatus* (Haswell, 1885) male specimen, AM P.78214, Port Jackson, New South Wales. SEM photographs: *(A)* whole animal lateral view (scale 200 µm); *(B)* head dorsal view (scale 100 µm); *(C)* gnathopod 2 propodus palm plumose setae (scale 20 µm); and *(D)* whole animal dorsal view (scale 200 µm).

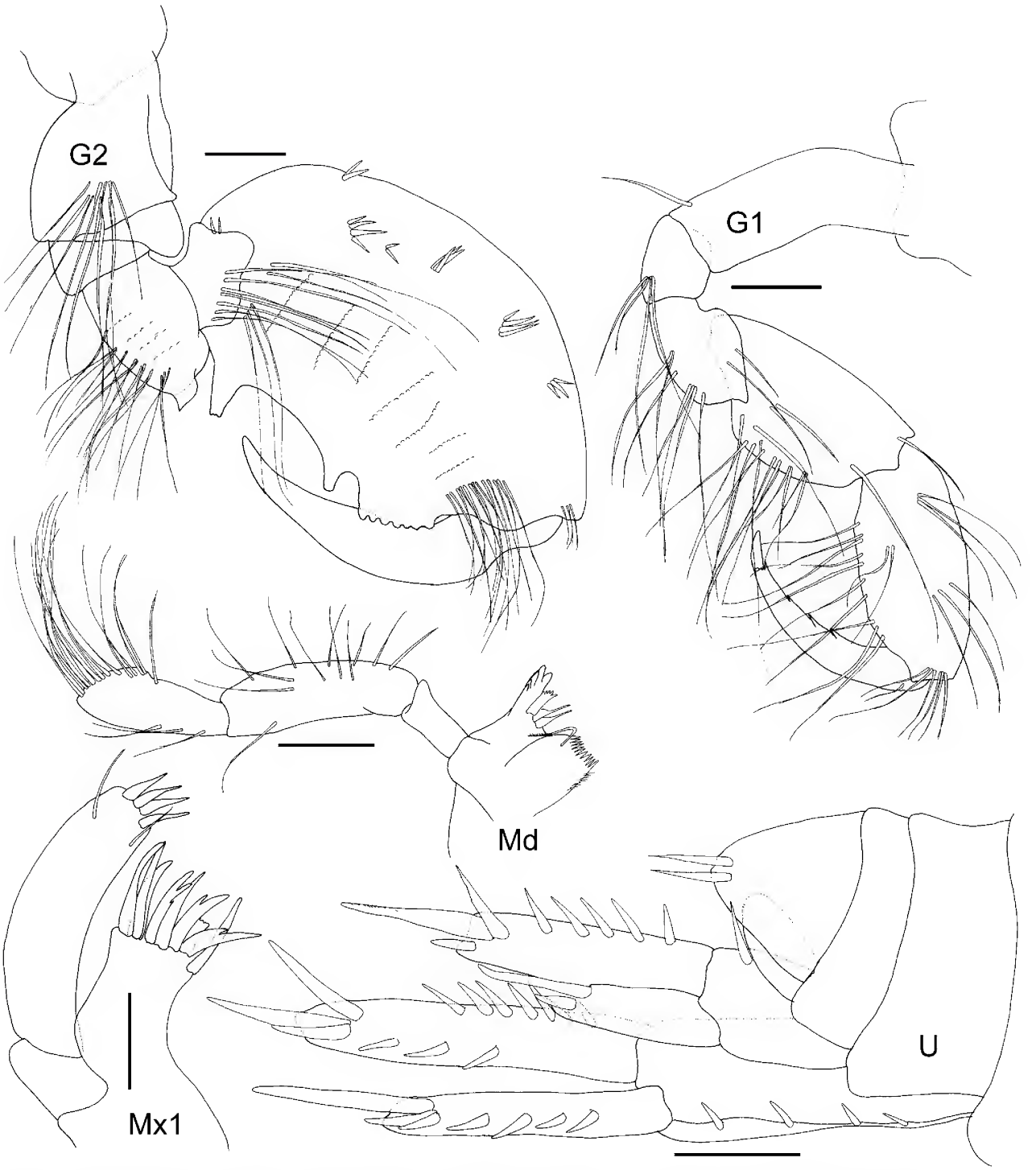

Figure 19. *Podocerus lobatus* (Haswell, 1885) neotype male, AM P.86212, 4.2 mm, Port Jackson, New South Wales (scales 0.1 mm).

Female. *Gnathopod 1* carpus rectolinear, twice as long as broad; propodus rectolinear, 2.1 times as long as broad. *Gnathopod 2* propodus spherical, as broad as long, palm convex, margin lined with humps, defined by tooth and 2 robust setae.

Description. Based on neotype, male, 4.2 mm, AM P.86212. *Body* cuticle dorsally rugose, with mainly posterior dorsal carina, laterally smooth. *Head* with weak hump; eyes greatly bulging; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Antenna 1* between 0.8 times body length; peduncle article 2 longer than article 3, primary flagellum 0.6 times peduncle length, with 4 articles; accessory flagellum 1-articulate, twice as long as broad. *Antenna 2* distinctly longer than antenna 1; flagellum about 0.2 times peduncle length; article 4 shorter than article 5; flagellum with 3 articles, posterior margin with line of short robust setae. *Mandible* accessory setal row with 2 setae. *Maxilla 1* palp distal margin with 4 robust setae.

Coxae 1–3 discontiguous, *coxae 4–7* contiguous. *Gnathopod 1* coxa subequal to coxa 2, as broad as long, distoventral corner not produced, anteroventral corner

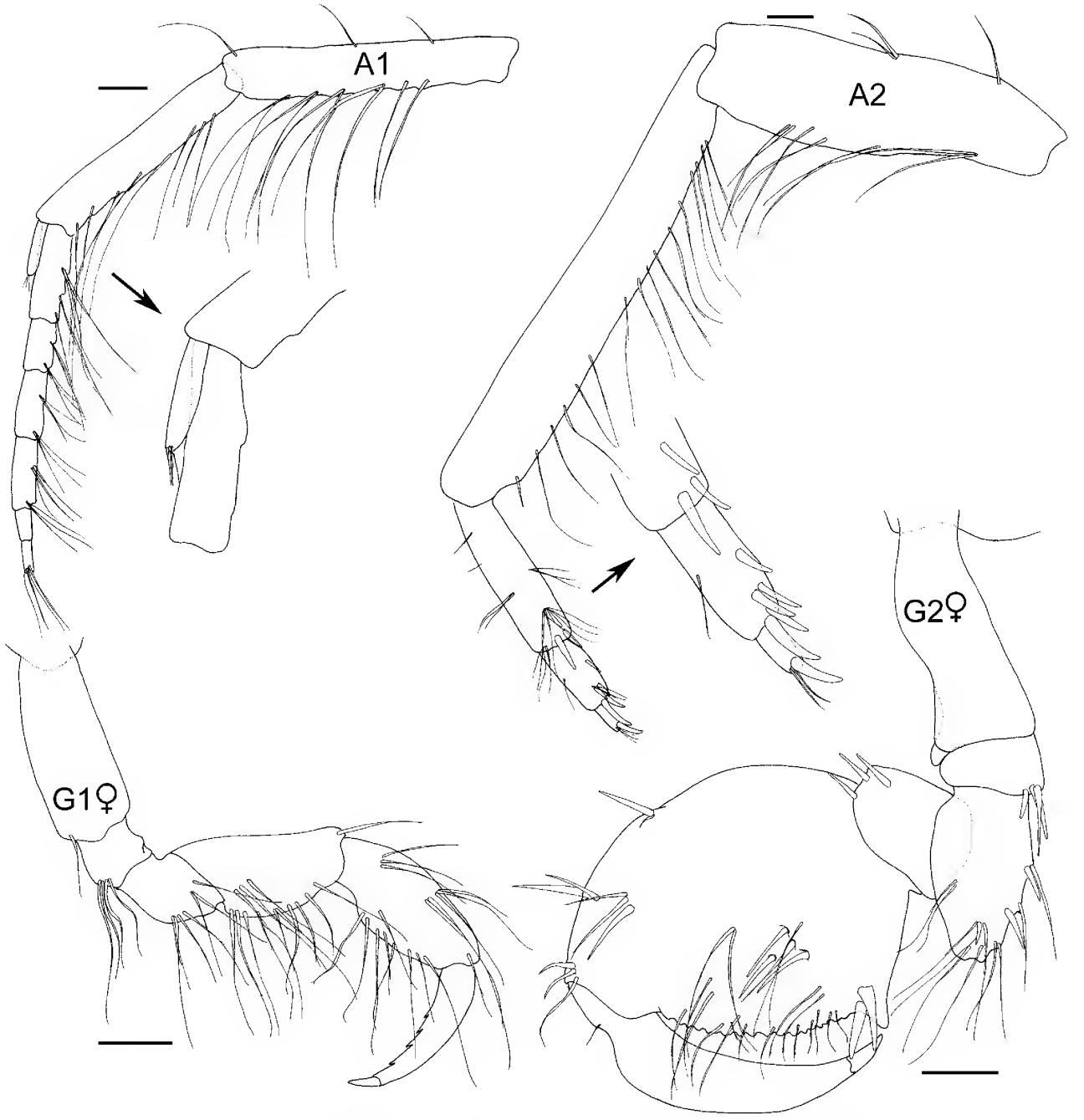

Figure 20. *Podocerus lobatus* (Haswell, 1885) female, AM P.86176, 4.9 mm, Port Jackson, New South Wales (scales represent 0.1 mm).

subacute; basis 3.1 times as long as broad, without anterodistal setae; carpus rectolinear, twice as long as broad; propodus subrectangular, 2.6 times as long as broad, anterior margin with clusters of long slender setae, palm margin smooth, without robust setae; dactylus posterior margin with 3 serrate teeth, cuticle surface smooth, closing along palm. *Pereonite 2* dorsal carina broad, produced evenly. *Gnathopod 2* basis 1.1 times as long as broad, anterodistal corner produced into rounded lobes, with clusters of plumose setae; merus posterior margin with narrow produced lobe, as long as broad, apically acute, without short robust setae; propodus subovate, 2.4 times as long as broad, anterior margin with clusters of long robust setae, propodus palm subacute, straight, palm subequal in length to propodus, with broad, well developed distal shelf, shelf margin strongly crenulate, palm with one proximal and one distal palm defining tooth, without robust setae; dactylus closing short of palm. *Pereonites 3–4* dorsal carina narrow, produced evenly. *Pereonite 5* dorsal carina narrow, produced posteriorly. *Pereonites 6–7* dorsal carina broad, produced posteriorly.

Pleonite 1 dorsal carina broad, produced evenly. *Epimera 1–3* rounded. *Urosome* with 3 pairs uropods. *Urosomite 1* short, twice as long as broad. *Uropod 1* peduncle 3 times as long as broad, without ventromedial spine; inner ramus subequal in lengths to peduncle; outer ramus about ¾ length of inner ramus. *Uropod 2* well developed; biramus, without ventromedial spine; outer ramus about half the length of inner ramus. *Uropod 3* uniramus; rami without setae. *Telson* dorsal lobe with 2 apical setae; lower margin without lateral setae or apical setae.

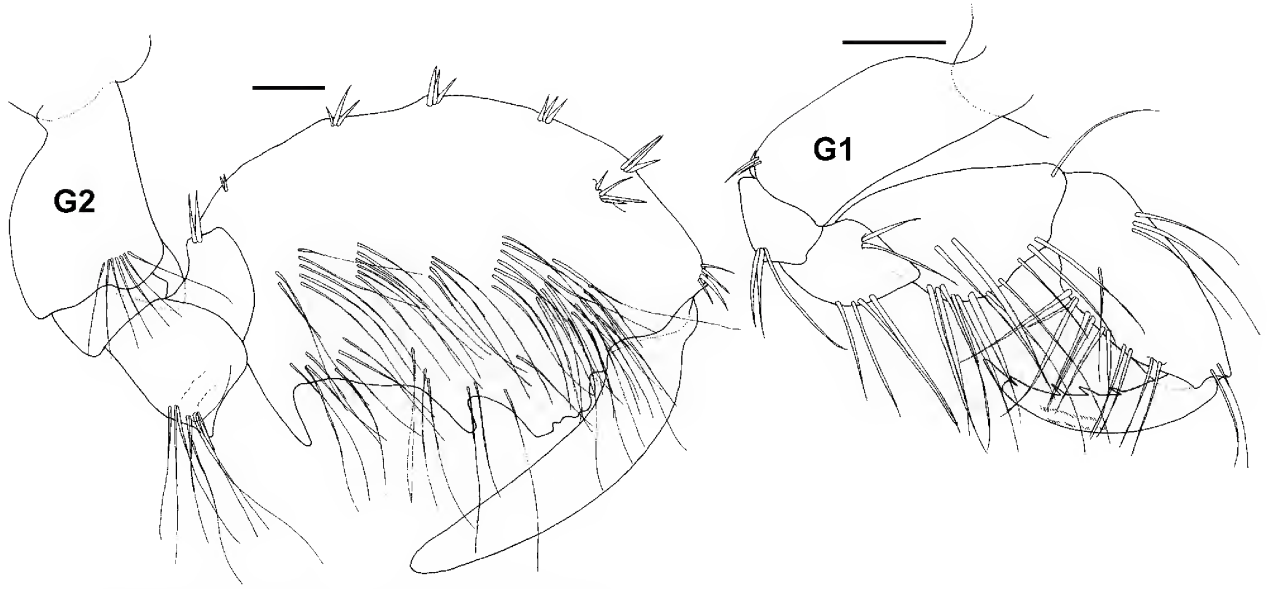

Figure 21. *Podocerus lobatus* (Haswell, 1885) male, AM P.86187, 4.0 mm, Fremantle, Western Australia (scales represent 0.1 mm).

Female (sexually dimorphic characters) based on female specimen, 4.9 mm, dissected, 1 slide, AM P.86176. *Gnathopod 1* basis anterior margin without robust setae; carpus rectolinear, twice as long as broad; propodus rectolinear, 2.1 times as long as broad, palm straight, define by corner, without robust setae; dactylus with 4 serrate teeth. *Gnathopod 2* basis anterodistal corner rounded; merus posterior margin with broad lobe, as long as broad, posterior margin apically rounded; propodus spherical, as broad as long, palm convex, about half length of propodus, without distal shelf, palm margin lined with humps, palm defined by tooth and 2 robust setae.

Remarks. See also remarks for *C. minutum*. Neotype material is from the type locality, Port Jackson. Material examined here provides a large range extension for this species across the southern coast of Australia. *Podocerus lobatus* has also been reported from the Aru Islands in Sulawesi, Indonesia (Pirlot, 1938). The limited illustrations of a male specimen from Sulawesi agree with the neotype drawn here. However, the Sulawesi material requires further consideration with *Podocerus cuspiclunis* Horton, 2008 from Hong Kong, which clearly represents a species very similar to *P. lobatus*. *Podocerus lobatus* can be differentiated from *P. cuspiclunis* by only two characters. In *P. lobatus* the maxilla palp has 4 robust setae while *P. cuspiclunis* has 6 robust setae. In females the gnathopod 2 propodus palm is crenulated in *P. lobatus*, as opposed to smooth in *P. cuspiclunis*. Further collections of both species, particularly from areas between tropical Hong Kong, Sulawesi and temperate southern Australia are needed to better understand this relationship.

Distribution. *New South Wales*. Port Stephens (Haswell, 1885); Port Jackson; Clovelly (current study). *Western Australia*. Fremantle; Dongara (current study). ?*Sulawesi*: Aru Islands (Pirlot, 1938).

Podocerus manawatu J. L. Barnard, 1972

Figs 22–24

Podocerus manawatu J. L. Barnard, 1972: 150–152, figs 81l, 82–84.—Lowry, 1974: 127, fig. 11 (key).

Type locality. Eve Bay, Wellington, New Zealand.

Material examined. *Victoria*. 1 male specimen, 5.5 mm, dissected, 2 slides, NMV J62400, off Eagles Nest, Bunurong (38°40'40"S 145°38'46"E), small plastic artificial substrate, 10–11 m, 1 April 1997, coll. T. O'Hara (Bun 3); 1 male specimen, SEM pin mount, AM P.85675, off Eagles Nest, Bunurong (38°40'40"S 145°38'46"E), small plastic artificial substrate, 10–11 m, 1 April 1997, coll. T. O'Hara (Bun 3); 2 specimens, NMV J57230, off Eagles Nest, Bunurong (38°40'40"S 145°38'46"E), small plastic artificial substrate, 10–11 m, 1 April 1997, coll. T. O'Hara (Bun 3); 1 female, 4.2 mm, dissected, 1 slide, NMV J57233, off Eagles Nest, Bunurong (38°40'40"S 145°38'46"E), small plastic artificial substrate, 10–11 m, 1 April 1997, coll. T. O'Hara (Bun 3); 2 specimens, NMV J57232, off Eagles Nest, Bunurong (38°40'40"S 145°38'46"E), small plastic artificial substrate, 10–11 m, 1 April 1997, coll. T. O'Hara (Bun 3); 2 specimens, NMV J57234, off Eagles Nest, Bunurong (38°40'40"S 145°38'46"E), 5–11 m, 1 April 1997, coll. T. O'Hara (Bun 4); 1 specimen, NMV J57235, off Eagles Nest, Bunurong (38°40'40"S 145°38'46"E), 5–11 m, 1 April 1997, coll. T. O'Hara (Bun 4); 20 specimens, NMV J56859, Beware Reef, near Cape Conran (37°49'21"S 148°47'23"E), 5–6 m, 15 April 1998, coll. T. O'Hara (WV 11); 1 specimen, NMV J56860, Beware Reef, near Cape Conran (37°49'21"S 148°47'23"E), 5–6 m, 15 April 1998, coll. T. O'Hara (WV 11); 4 specimens, NMV J56861, Schomberg Reef, near Peterborough, (38°36'49"S 142°53'19"E), 3.5–5 m, 19 May 1998, coll. T. O'Hara (WV 2).

Diagnosis. *Head* dorsally smooth; *eyes* not bulging from head. *Gnathopod 1* propodus subrectangular, with 5 robust setae near corner of palm. *Gnathopod 2* basis 1.2 times as long as broad; propodus subovate, palm without distal shelf, lined with 8 humps, defined by 3 robust setae.

Female. *Gnathopod 1* carpus rectolinear, 1.5 times as long as broad; propodus subovoid, twice as long as broad. *Gnathopod 2* propodus 1.2 times as long as broad.

Description. Based on 1 male specimen, 5.5 mm, dissected, 2 slides, NMV J62400. *Body* cuticle dorsally smooth, without lateral and ventral carina. *Head* dorsally smooth; *eyes* not bulging from head; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Mandible* accessory setal row with 4 setae. *Maxilla 1* palp distal margin broken.

Coxae 1–3 discontiguous, *coxae 4–7* contiguous.

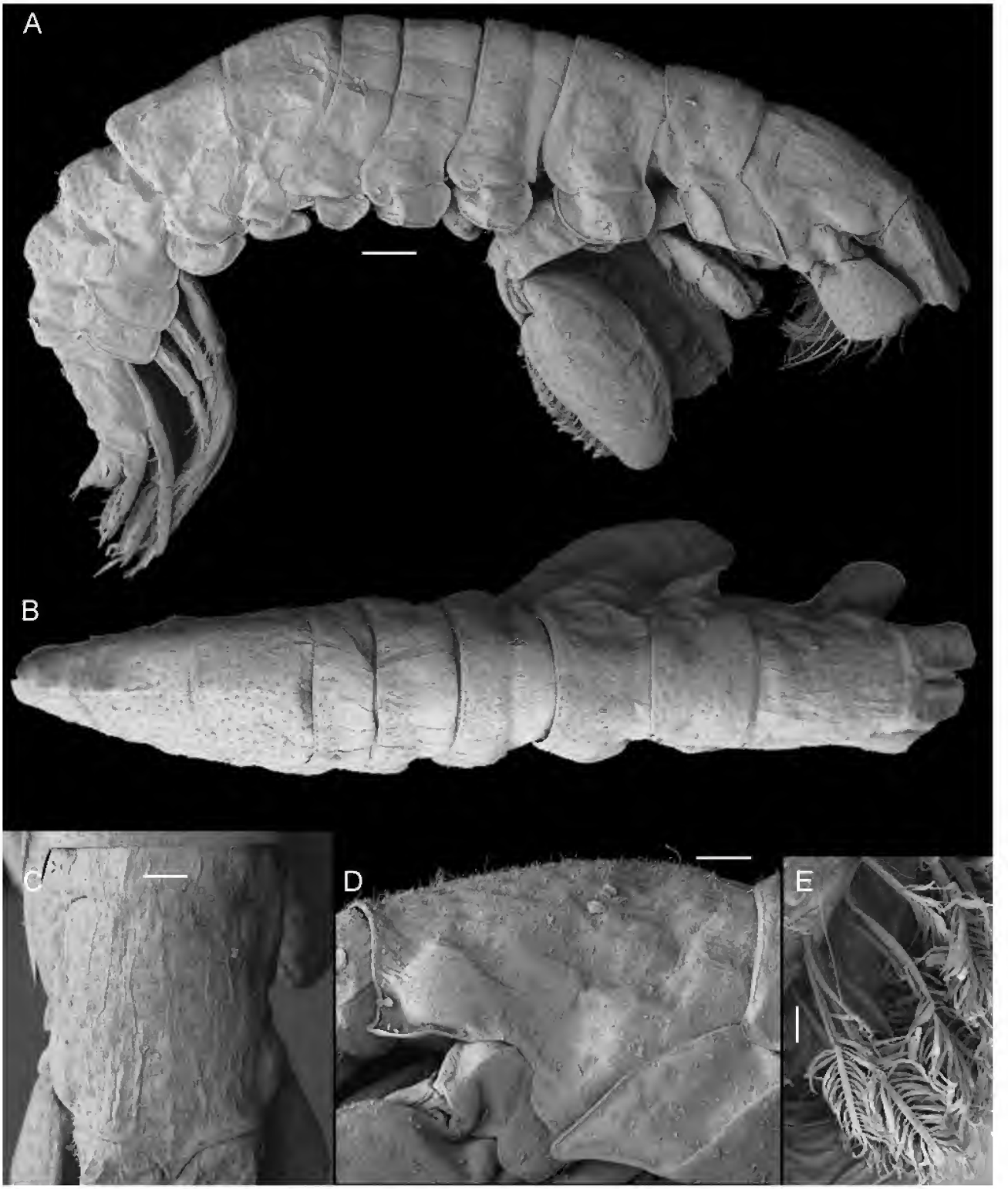

Figure 22. *Podocerus manawatu* J. L. Barnard, 1972 male specimen, AM P.85675, Bunurong, Victoria. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 200 μm); *(C)* head dorsal view (scale 100 μm); *(D)* head lateral view (scale 100 μm); and *(E)* gnathopod 2 propodus palm plumose setae (scale 20 μm).

Gnathopod 1 coxa as broad as long, distoventral corner weakly produced anteriorly, corner subacute; basis twice as long as broad, with a few long slender anterodistal setae; carpus subtriangular, 1.1 times as long as broad; propodus subrectangular, 2.2 times as long as broad, anterior margin with clusters of long slender setae, palm margin smooth, with 5 robust setae near corner of palm; dactylus posterior margin with 6 serrate teeth, cuticle surface with raised serrations, closing along palm. *Gnathopod 2* basis 1.2 times as long as broad, anterodistal corner subquadrate, with long slender setae; merus posterior margin with narrow produced lobe, as long as broad, apically acute; propodus subovate, 1.8 times

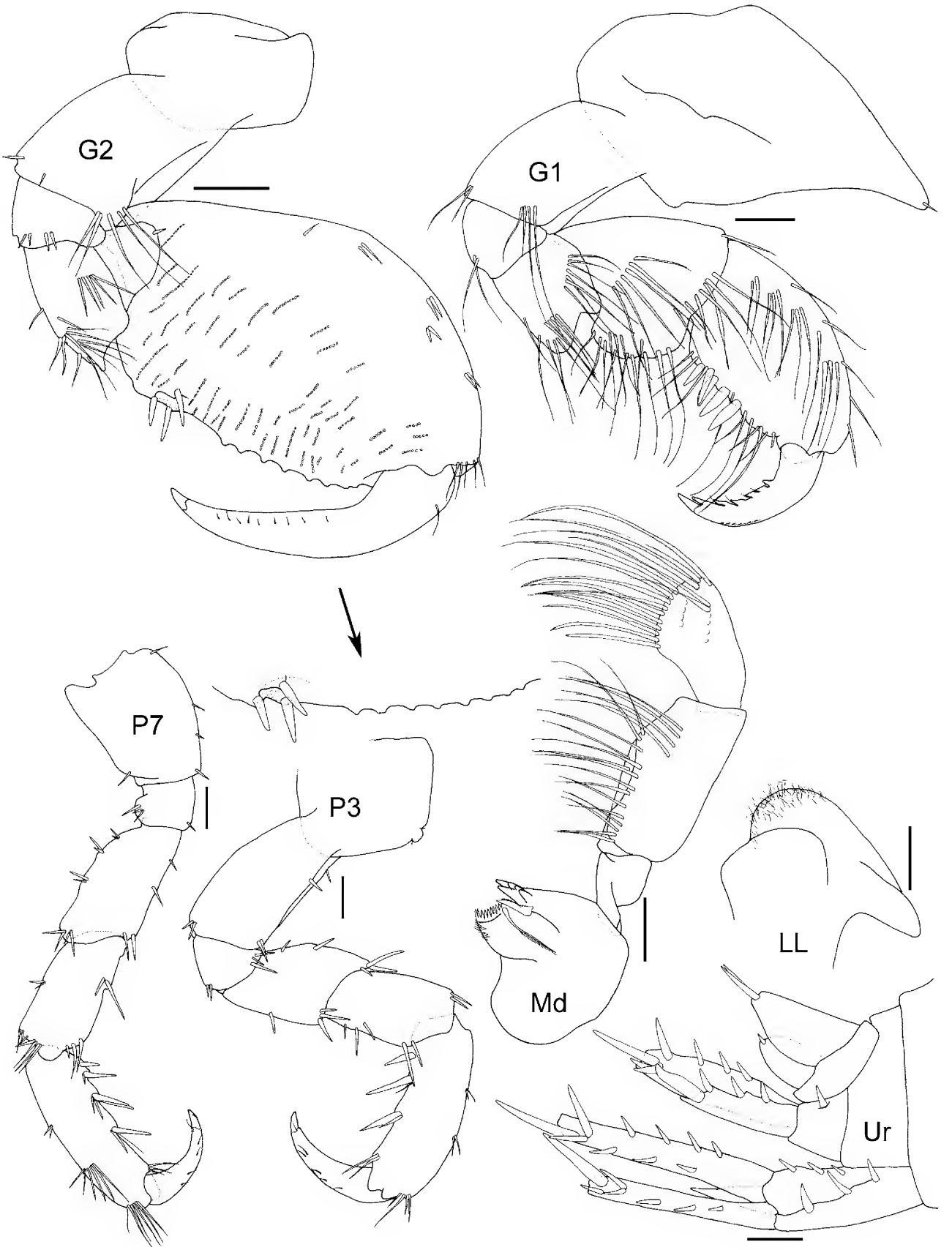

Figure 23. *Podocerus manawatu* J. L. Barnard, 1972 male, NMV J62400, 5.5 mm, Bunurong, Victoria (scales represent 0.1 mm).

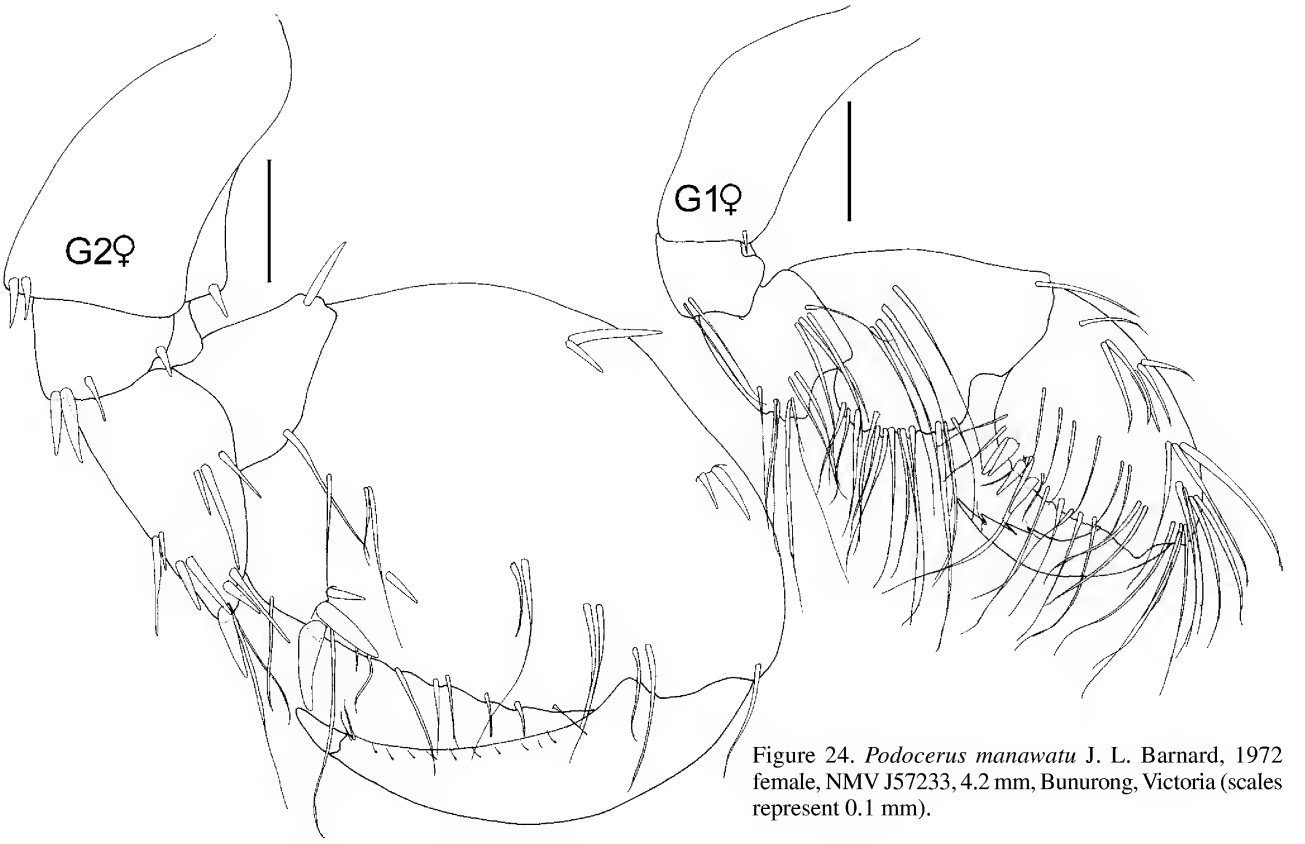

Figure 24. *Podocerus manawatu* J. L. Barnard, 1972 female, NMV J57233, 4.2 mm, Bunurong, Victoria (scales represent 0.1 mm).

as long as broad, anterior margin with clusters of short robust setae, palm acute, straight, ¾ length of propodus, without distal shelf, palm lined with 8 humps, defined by 3 robust setae; dactylus closing along palm.

Epimeron 1 rounded, *epimera 2–3* subquadrate. *Urosome* with 3 pairs of uropods. *Urosomite 1* short, twice as long as broad. *Uropod 1* peduncle 3 times as long as broad, with well developed ventromedial spine 2.5 times as long as broad; inner ramus longer than peduncle; outer ramus about ¾ length of inner ramus. *Uropod 2* well developed, biramus, without ventromedial spine; outer ramus about half the length of inner ramus. *Uropod 3* uniramus; rami with apical setae. *Telson* dorsal lobe with 2 apical setae; lower margin without lateral or apical setae.

Female (sexually dimorphic characters) based on female specimen, 4.2 mm, NMV J57233. *Gnathopod 1* basis anterior margin with robust seta; carpus rectolinear, 1.5 times as long as broad; propodus subovoid, twice as long as broad, palm straight, defined by corner with 4 robust setae; dactylus posterior margin with 4 serrate teeth. *Gnathopod 2* basis anterodistal corner subquadrate with 1 robust seta; merus posterior margin lobe broadly rounded, as broad as long, with 3 short robust setae; propodus subovoid, 1.2 times as long as broad, anterior margin with long robust setae, palm smooth, ¾ length of propodus, defined by 3 robust setae.

Remarks. This is the first record of *P. manawatu* outside of New Zealand. No gravid females were present in the small number of specimens available.

Distribution. New Zealand. Wellington, Dunedin, Kaikoura, Gisborne, Whangaparaoa peninsula, Leigh (Lowry, 1974). Australia. *Victoria*: Cape Conran, Peterborough, Bunurong (current study)

Podocerus oliphant sp. nov.

Figs 25–27

Type material. Holotype male, 5.1 mm, dissected, 3 slides, AM P.86188, Elephant Rock, north of St Helens Point (41°17'30"S 148°20'E), 20 m, sponges on rocky substrate, 14 April 1991, coll. R. Springthorpe & C. McCormick (Tas 136); paratype female, 3.7 mm, dissected, 1 slide, AM P.86189, St Helens Rocks (41°17'30"S 148°22'E) 10 m, encrusting sponges on rocks among kelp *Ecklonia* sp and *Cystophora* sp., coll. R. T. Springthorpe and C. J. McCormick, 13 April 1991 (Tas 123); paratype male specimen, SEM pin mount, AM P.84117, Elephant Rock, north of St Helens Point (41°17'30"S 148°20'E), 20 m, sponges on rocky substrate, 14 April 1991, coll. R. Springthorpe & C. McCormick (Tas 136; paratypes, 5 specimens, AM P.83636, St Helens Rocks (41°17'30"S 148°22'E) 10 m, encrusting sponges on rocks among kelp *Ecklonia* sp and *Cystophora* sp., coll. R. T. Springthorpe and C. J. McCormick, 13 April 1991 (Tas 123); paratype, 1 specimen, AM P.83637, Elephant Rock, north of St Helens Point (41°17'30"S 148°20'E), 20 m, sponges on rocky substrate, 14 April 1991, coll. R. Springthorpe & C. McCormick (Tas 136); paratypes 9 specimens, AM P.83635, St Helens Rocks (41°17'30"S 148°22'E), 10 m, macroalgae *Ecklonia* sp. holdfasts, 13 April 1991, coll. R. Springthorpe & C. McCormick (Tas 113); paratypes 2 specimens, AM P.83638, St Helens Rocks (41°17'30"S 148°22'E), 15 m, bryozoan, 13 April 1991, coll. R. Springthorpe & C. McCormick (Tas 115).

Type locality. Elephant Rock, north of St Helens Point, Tasmania, Australia (41°17'30"S 148°20'E).

Etymology. Named from the type locality Elephant Rock, using the old english spelling for elephant = oliphant, applied as a noun in apposition.

Additional material examined. *Victoria*. 6 specimens, NMV J56864, Sailor's Grave, off East Cape Conran (37°48"13'S 148°44"41'E), 4–5 m, 10 April 1998 (WV 12); 9 specimens, NMV J56862, Sailor's Grave, off East Cape Conran (37°48'13"S 148°44'41"E), 4–5 m, 10 June 1998, coll. T. O'Hara (WV 12).— *Tasmania*. 2 specimens, SAMA C6552, Frying Pan Point northern side, Port Arthur, Tasman Peninsula (43°8'31"S 147°51'34"E), 6–12 m in bryozoans, 30 July 1991, coll. K. L. Gowlett-Holmes and G. Myors.

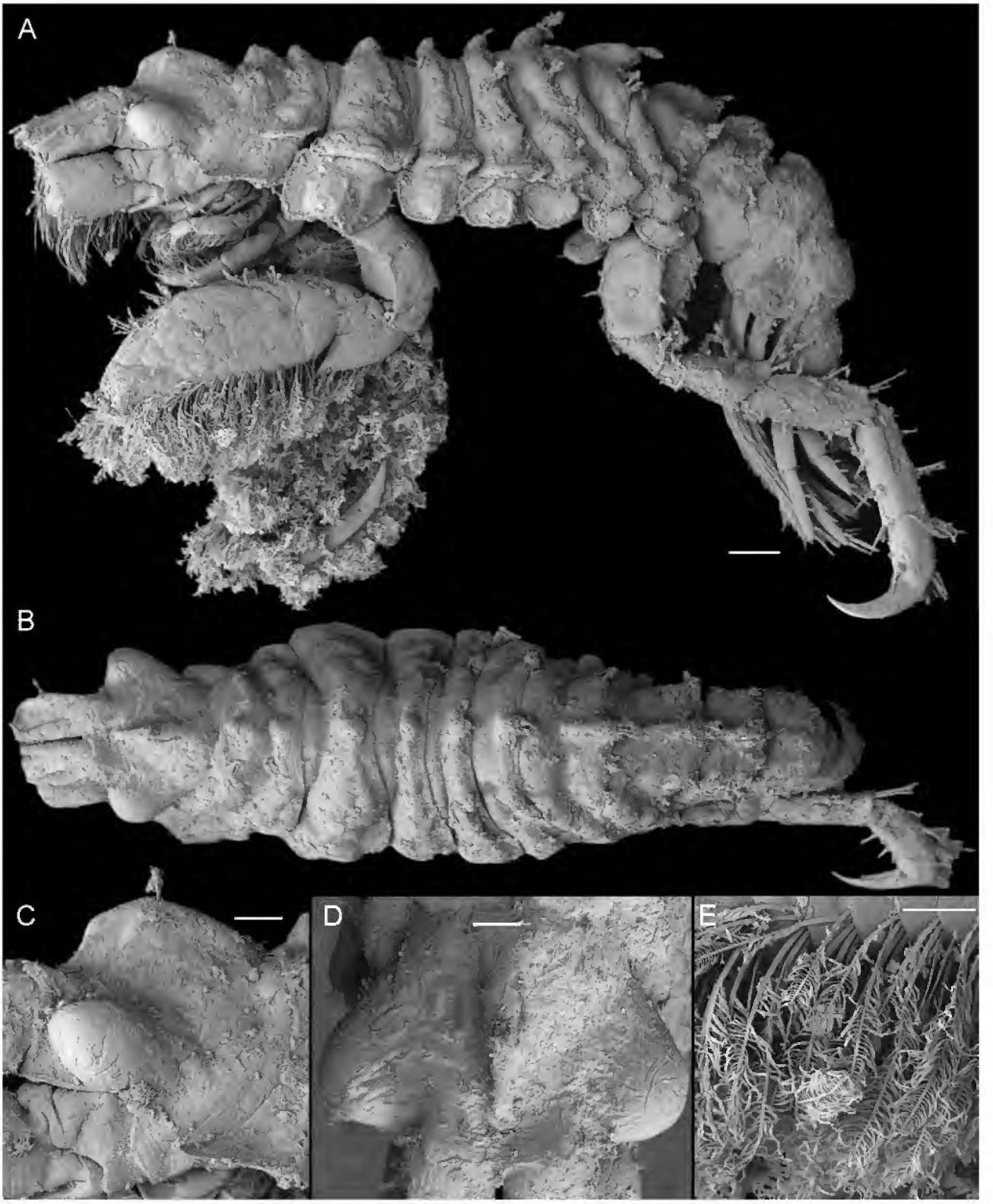

Figure 25. *Podocerus oliphant* sp. nov. male specimen, AM P.84117, St Helens Point, Tasmania. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 100 µm); *(C)* head lateral view (scale 100 µm); *(D)* head dorsal view (scale 100 µm); and *(E)* gnathopod 2 propodus palm plumose setae (scale 100 µm).

Diagnosis. *Head* with well developed hump. *Pereonite 1* with two dorsal carina, subtriangular, produced dorsally, apically rounded. *Coxae 1–7* contiguous. *Gnathopod 1* propodus with 5 robust setae near corner of palm. *Pereonite 2* dorsal carina produced evenly, subtriangular, apically rounded. *Gnathopod 2* propodus elongate subovoid, with one rectangular and one subtriangular tooth, palm with small defining tooth and without robust setae. *Pereonites 3–4* dorsal carina produced evenly, subtriangular, apically rounded. *Pereonites 5–6* dorsal carina subtriangular, produced posteriorly, apically

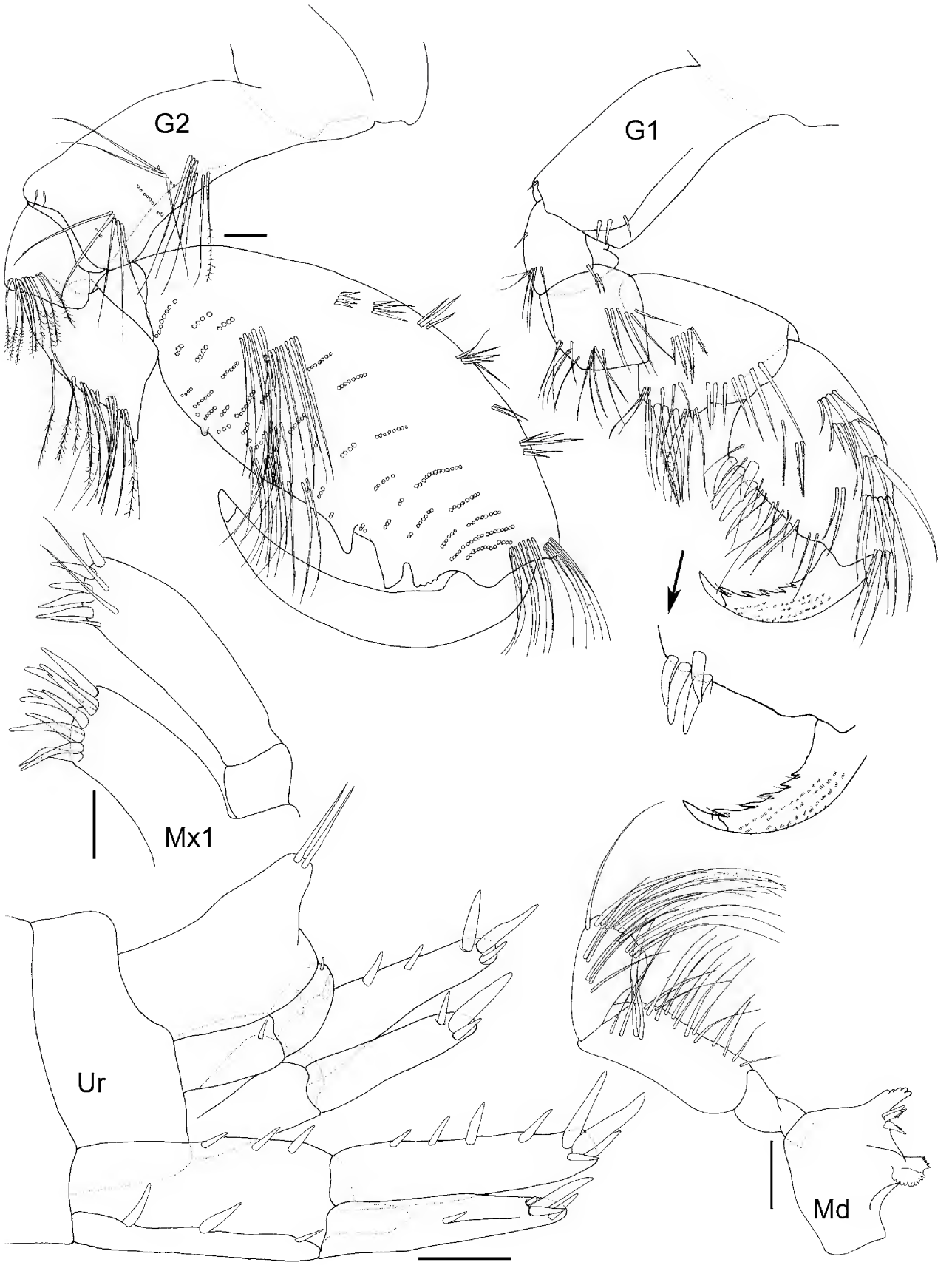

Figure 26. *Podocerus oliphant* sp. nov., holotype male, AM P.86188, 5.1 mm, St Helens Point, Tasmania (scales represent 0.1 mm).

Figure 27. *Podocerus oliphant* sp. nov., paratype female, AM P.86189, 3.7 mm, St Helens Point, Tasmania (scales represent 0.1 mm).

subacute. *Pereonite 7* dorsal carina subtriangular, produced posteriorly, apically rounded. *Pleonites 1–2* dorsal carina, produced evenly, with weak hump.

Female. *Gnathopod 1* carpus rectolinear, 1.7 times as long as broad; propodus subtriangular, 1.6 times as long as broad. *Gnathopod 2* basis anterodistal corner rounded, with many robust setae; propodus spherical, palm lined with 5 humps.

Description. Based on holotype male, 5.1 mm, AM P.86188. *Body* cuticle dorsally processiferous, with carina along entire dorsal surface, laterally smooth. *Head* with well developed hump; *eyes* greatly bulging; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Mandible* accessory setal row with 3 setae. *Maxilla 1* palp distal margin with 5 robust setae.

Pereonite 1 with two dorsal carina, subtriangular, produced dorsally, apically rounded. *Coxae 1–7* contiguous. *Gnathopod 1* coxa smaller than coxa 2, as broad as long, distoventral corner produced anteriorly, corner subacute; basis 2.1 times as long as broad, with anterodistal robust seta; carpus subtriangular, 1.5 times as long as broad; propodus subtriangular, twice as long as broad, anterior margin with clusters of long slender setae, palm margin smooth, with 5 robust setae near corner of palm; dactylus posterior margin with 5 serrate teeth, cuticle surface with raised serrations, closing along palm. *Pereonite 2* dorsal carina produced evenly, subtriangular, apically rounded. *Gnathopod 2* basis 2.2 times as long as broad, anterodistal corner rounded produced lobes, with rows of plumose setae; merus posterior margin with narrow produced lobe, as long as broad, apically acute, anterior margin without short robust setae; propodus elongate subovoid, 2.3 times as long as broad, anterior margin with clusters of short slender and robust setae, palm acute, straight, with broad, well developed distal shelf, shelf margin crenulate, with one rectangular and one subtriangular tooth, with small palm defining tooth, without robust setae; dactylus closing short of palm end. *Pereonites 3–4* dorsal carina produced evenly, subtriangular, apically rounded. *Pereonites 5–6* dorsal carina subtriangular, produced posteriorly, apically subacute. *Pereonite 7* dorsal carina subtriangular, produced posteriorly, apically rounded.

Pleonites 1–2 dorsal carina, produced evenly, with weak hump. *Epimera 1–3* posteroventral corner rounded. *Urosomite 1* short, twice as long as broad. *Urosome* with 3 pairs of uropods. *Uropod 1* peduncle 2.5 times as long as broad, with well developed ventromedial spine twice as long as broad; inner ramus subequal to peduncle length; outer ramus slightly shorter than inner ramus. *Uropod 2* well developed, biramus, without ventromedial spine; outer ramus slightly shorter than inner ramus. *Uropod 3* uniramus; rami with apical setae. *Telson* dorsal lobe with 2 apical setae, without lateral or apical setae.

Female (sexually dimorphic characters) based on paratype female, 3.7 mm, AM P.86189. *Gnathopod 1* basis anterior margin without robust setae; carpus rectolinear, 1.7 times as long as broad; propodus subtriangular, 1.6 times as long as broad, palm convex with 3 robust setae near corner of palm; dactylus posterior margin with 4 serrate teeth. *Gnathopod 2* basis anterodistal corner rounded, with many robust setae; merus posterior margin with broad produced lobe, apically subacute, without robust setae; propodus spherical, 1.2 times as long as broad, anterior margin with clusters of long robust setae, palm convex, ⅔ length of propodus, palm lined with 5 humps, palm defining corner with 3 robust setae; dactylus closing along palm.

Remarks. The carinae along the head and entire dorsal surface of *P. oliphant* sp. nov. aligns it with *P. danae* (Stebbing, 1888), *P. hystrix, P. hoonsooi* Kim & Kim, 1991, *P. palinuroides* Ledoyer, 1986 and *P. inconspicuus. Podocerus oliphant* sp. nov. and *P. palinuroides* are without lateral and ventral carina, separating them from the later group where these carina are present on some or all pereonites.

In *P. oliphant* sp. nov. the male gnathopod 2 propodus has a weak proximal and strong distal tooth and *P. palinuroides* has both proximal and distal teeth well developed.

Podocerus oliphantus sp. nov. also similar to *P. dentatus* and *P. lobatus*, see these species remarks for distinctions.

Distribution. Australia. *Tasmania*: St Helens Point; Tasman Peninsula (current study). *Victoria*: Cape Conran (current study).

Podocerus tamoshanta sp. nov.

Figs 28–30

Type material. Holotype male, 2.8 mm, dissected, 2 slides, AM P.77155, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 18 m, sponge and gorgonacean, 1 May 1997, coll. K. B. Attwood (NSW 1286); paratype female, 2.6 mm, dissected, 1 slide, AM P.77146, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 17 m, brown alga *Dictyota* sp. on rock ledge, 1 May 1997, coll. A. Murray (NSW 1279); paratype male 1 specimen, AM P.77155, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 18 m, sponge and gorgonacean, 1 May 1997, coll. K. B. Attwood (NSW 1286); paratype male SEM pin mounted specimen, AM P.78211, 150 m east of Burrill Rocks, southern end of Lighthouse Reef, Ulladulla (35°23'24"S 150°28'10"E), 19 m, on surface of sponges, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1278); 1 specimen, AM P.77146, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 17 m, brown alga *Dictyota* sp. on rock ledge, 1 May 1997, coll. A. Murray (NSW 1279); 1 specimen, AM P.77142, 150 m east of Burrill Rock, Ulladulla (35°23'24"S 150°28'10"E), 10 m, kelp *Ecklonia* sp. holdfasts, 1 May 1997, coll. A. Murray (NSW 1277); 3 specimens, AM P.77143, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 19 m, on surface of sponges, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1278).

Type locality. Burrill Rocks, Ulladulla, New South Wales, Australia (35°23'24"S 150°28'10"E).

Etymology. A tamoshanter is a round Scottish cap with a pompon of feathers on top. The name is applied here in reference to the dorsal surface of the head segment which has an apically setose round nodule resembling a tamoshanter.

Additional material examined. *New South Wales*. 1 SEM pin mounted specimen, AM P.78210, southern end of Lighthouse Reef, Ulladulla (35°22'8"S 150°29'18"E), 16 m, bryozoan, 30 April 1997, coll. P. B. Berents and K. B. Attwood (NSW 1267); 2 specimen, AM P.77137, southern end of Lighthouse Reef, Ulladulla (35°22'8"S 150°29'18"E), 16 m, bryozoan *Orthoscuticella* sp., 30 April 1997, coll. P. B. Berents and K. B. Attwood (NSW 1267); 1 specimen, AM P.77140, southern end of Lighthouse Reef, Ulladulla (35°22'8"S 150°29'18"E), 16 m, with

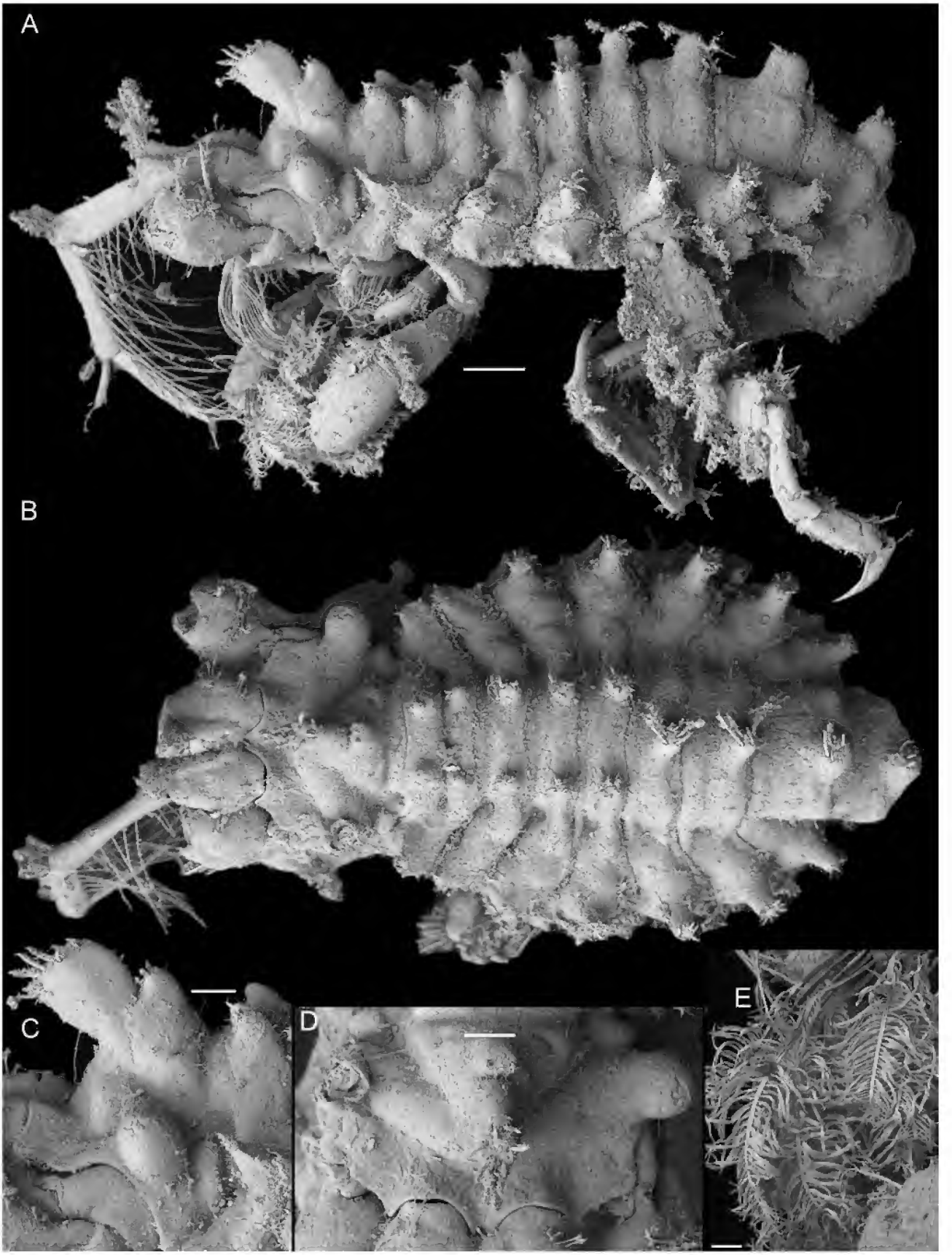

Figure 28. *Podocerus tamoshanta* sp. nov. male specimen, AM P.78211, Ulladulla, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 200 µm); *(C)* head lateral view (scale 100 µm); *(D)* head dorsal view (scale 100 µm); *(E)* gnathopod 2 propodus palm plumose setae (scale 30 µm).

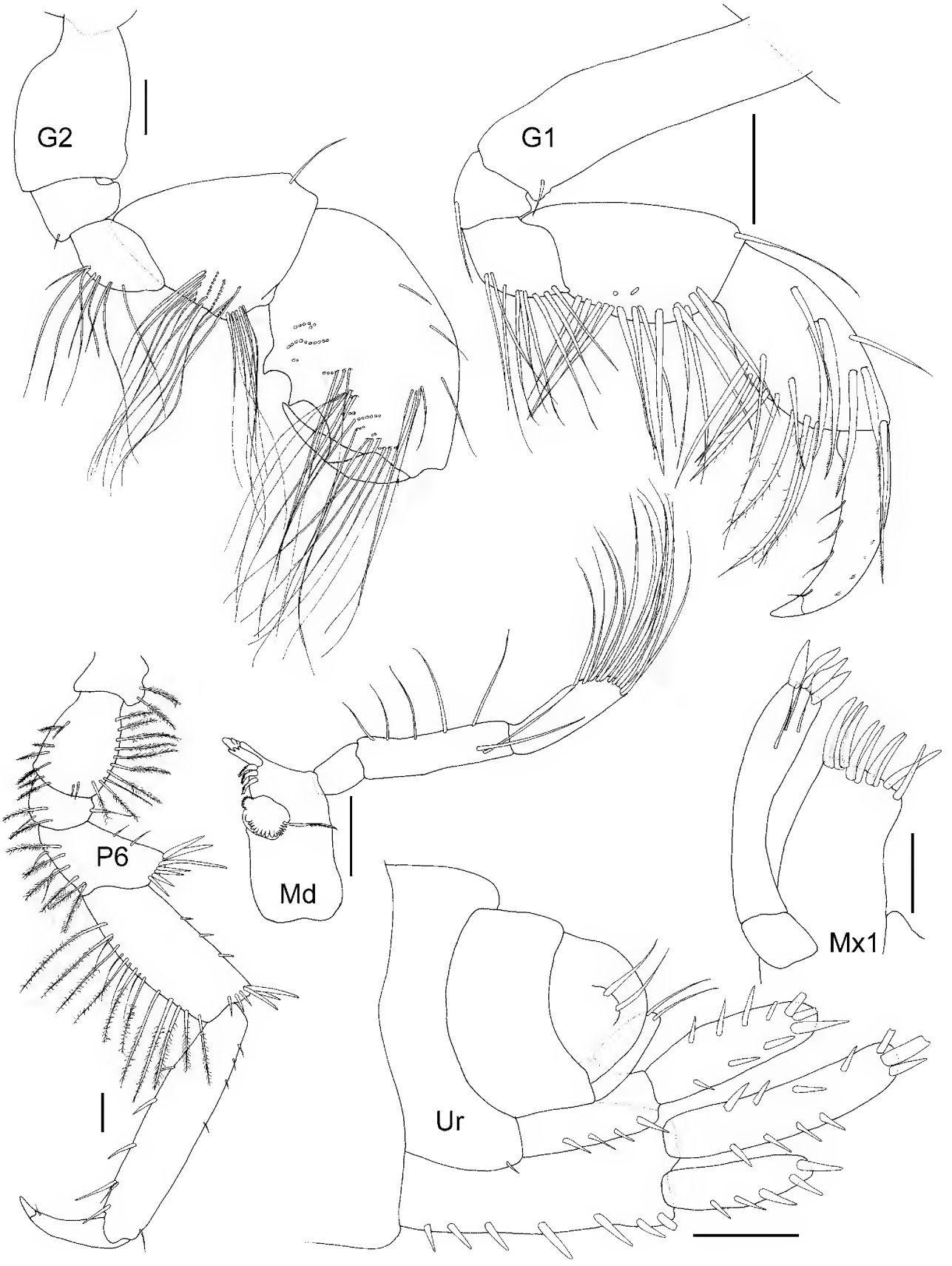

Figure 29. *Podocerus tamoshanta* sp. nov., holotype male, AM P.77155, 2.8 mm, Ulladulla, New South Wales (scales represent 0.1 mm).

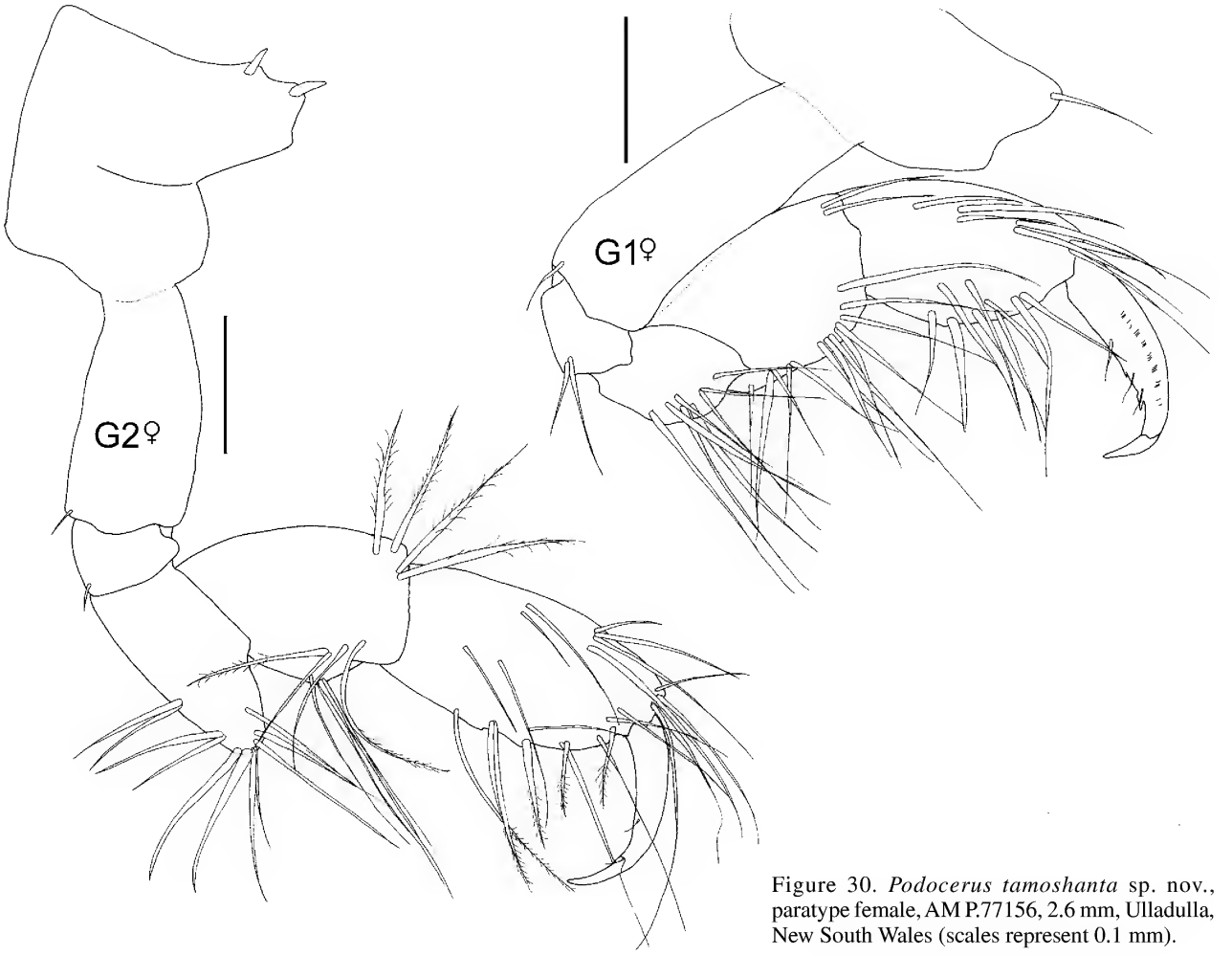

Figure 30. *Podocerus tamoshanta* sp. nov., paratype female, AM P.77156, 2.6 mm, Ulladulla, New South Wales (scales represent 0.1 mm).

polychaete tubes of *Filograna* sp. on top and under large boulder, 30 April 1997, coll. P. B. Berents and K. B. Attwood (NSW 1271); 1 specimen, AM P.86190, southern end of Lighthouse Reef, Ulladulla (35°22'8"S 150°29'18"E), 15 m, underside of large boulder, 30 April 1997, coll. P. Berents and K. Attwood (NSW 1265); 1 specimen, AM P.77165, Halfway Reef, 200 m south of Sullivan Reef, Ulladulla (35°21'25"S 150°29'18"E), 13 m, *Ecklonia* sp. holdfasts, 3 May 1997, coll. A. Murray (NSW 1304); 5 specimens, AM P.83996, west side of Box Head, Broken Bay (33°33'S 151°21'E), no depth, sponge, 22 November 1982, coll. J. K. Lowry and R. T. Springthorpe (NSW 171); 1 specimen, AM P.86191, northeast of Port Stephens, northeast side of Little Broughton Island, Port Stephens (32°37'05"S 152°20'06"E), 17.3 m, curly orange bryozoan, rock reef with gutters and sand patches, 11 March 2006, coll. S. J. Keable (NSW 2940); 1 specimen, AM P.86192, northeast of Port Stephens, northeast side of Little Broughton Island, Port Stephens (32°37'05"S 152°20'06"E), 17 m, alga *Ecklonia* sp. holdfasts, coll. R. T. Springthorpe (NSW 2933).—*South Australia*. 1 specimens, NMV J57132, northern side of West Island (35°37'00"S 138°36'00"E), 4 m, 21 March 1985 (SA 45).—*Western Australia*. 1 specimen, AM P.79492, southern side of Kendrew Island, Dampier Archipelago (20°28.987'S 116°32.549'E), 4.4 m, on brown alga *Sargassum* sp. in sand, 30 August 1999, coll. R. A. Peart (WA 692).

Diagnosis. *Head* with small nodule and apical setae; *eyes* practically stalked. *Pereonite 1* with two pair of carina, developed as a small nodule with apical setae, ventral projections present. *Gnathopod 1* basis 4 times as long as broad; propodus subrectangular to subovate, without robust seta at corner of palm. *Pereonite 2* dorsal carina developed as a pair of nodules with apical setae, ventral projections present. *Gnathopod 2* basis 1.9 times as long as broad; propodus, palm concave, with two subtriangular teeth, without palm defining robust setae. *Pereonites 3–4* dorsal carina developed as a pair of nodules with apical setae, ventral projections present. *Pereonites 5–7* dorsal carina developed as a single nodule with apical setae, ventral projections present. *Pereopod 6* articles lined with long plumose setae. *Pleonites 1–2* dorsal carina developed as a single nodule with apical setae, lateral projections present. *Uropod 2* reduced, uniramus.

Female. *Gnathopod 1* carpus rectolinear, 1.5 times as long as broad; propodus subovate, 1.6 times as long as broad. *Gnathopod 2* merus posterior margin broad, without robust setae; propodus rectolinear, twice as long as broad, without palm defining corner or robust setae.

Description. Based on holotype male, 2.8 mm, AM P.77155. *Body* cuticle dorsally and ventrally rugose. *Head* with small nodule and apical setae; *eyes* practically stalked; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Antenna 1* 0.5 times body length; peduncle article 2 subequal to article 3; primary flagellum 0.5 times peduncle length; accessory flagellum 1-articulate, long, three times as long as broad (based on AM P.78211). *Mandible* accessory setal row with 3 setae. *Maxilla 1* palp distal margin with 4 robust setae.

Pereonite 1 with two pair of carina, developed as a small nodule with apical setae, ventral projections present. *Coxae 1–3* discontiguous, *coxae 4–7* contiguous. *Gnathopod*

1 coxa distoventral corner weakly produced anteriorly, apically subacute; basis 4 times as long as broad, with anterodistal robust seta; carpus rectolinear, twice as long as broad; propodus subrectangular to subovate, 2.2 times as long as broad, anterior margin with clusters of long slender setae, palm margin smooth, without robust seta at corner of palm; dactylus posterior margin smooth, cuticle surface with raised serrations, closing along palm. *Pereonite 2* dorsal carina developed as a pair of nodules with apical setae, ventral projections present. *Gnathopod 2* basis 1.9 times as long as broad, anterodistal corner without lobes, without setae; merus without posterior produced lobe, 1.8 times as long as broad; propodus subovoid, twice as long as broad, anterior margin with a few long slender setae, palm concave, about half length of propodus, with broad, well developed triangular distal shelf, shelf margin smooth, palm with two subtriangular teeth, without palm defining robust setae; dactylus articulating with midpalmar tooth. *Pereonites 3–4* dorsal carina developed as a pair of nodules with apical setae, ventral projections present. *Pereonites 5–7* dorsal carina developed as a single nodule with apical setae, ventral projections present. *Pereopod 6* articles lined with long plumose setae.

Pleonites 1–2 dorsal carina developed as a single nodule with apical setae, lateral projections present. *Epimera 1–3* posteroventral corner rounded. *Urosome* with 3 pairs of uropods. *Urosomite* 1 short, 1.5 times as long as broad. Uropod 1 peduncle elongate, 2.5 times as long as broad, without ventromedial spine; inner ramus 1.1 times peduncle length; outer ramus about half the length of inner ramus. *Uropod 2* reduced, uniramus; peduncle without ventromedial spine; rami subequal in length to peduncle. *Uropod 3* uniramus; rami with apical setae. *Telson* dorsal lobe with 2 apical setae, lower margin without lateral or apical setae.

Female (sexually dimorphic characters) based on paratype female, 2.6 mm, AM P.77146. *Gnathopod 1* basis anterior margin without setae; carpus rectolinear, 1.5 times as long as broad; propodus subovate, 1.6 times as long as broad, palm weakly convex, without palm defining corner or robust setae; dactylus posterior margin with 2 serrate teeth. *Gnathopod 2* basis anterodistal corner subquadrate, without robust setae; merus posterior margin broad, lobes 1.1 times as broad as long, apically rounded, without robust setae; propodus rectolinear, twice as long as broad, anterior margin with clusters of long slender setae, palm acute, convex, smooth, without palm defining corner or robust setae; dactylus closing along palm.

Remarks. The nodule style carinations along the head and dorsal surface of *P. tamoshanta* sp. nov. is unique within the family. A further derived character is the pereopods 5 to 7 margins lined with plumose setae. *Podocerus tamoshanta* sp. nov. expands the generic description of the genus to include the uniramus uropod 2, however all other characters of this species agree with the genus *Podocerus*. A uniramus uropod 2 is not reported elsewhere in the Podoceridae though many genera have varying degrees of vestigial urosome articles.

Distribution. Australia. *New South Wales*: Ulladulla, Port Stephens (current study). *South Australia*: West Island (current study). *Western Australia*. Dampier Archipelago (current study).

Podocerus vulgaris sp. nov.

Figs 31–33

Type material. Holotype male, 6.2 mm, dissected, 2 slides, AM P.86193; paratype female specimen, 4.2 mm, dissected, 1 slide, AM P.86194, 20+ specimens, AM P.77188, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 22 m, red alga, 7 May 1997, coll. A. Murray (NSW 1356); paratype 1 SEM pin mounted specimen, AM P.78205, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 22 m, red alga, 7 May 1997, coll. A. Murray (NSW 1356); paratype 1 SEM pin mounted specimen, AM P.78206, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 22 m, red alga, 7 May 1997, coll. A. Murray (NSW 1356); paratypes 6 specimens, AM P.77190, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 20 m, dead lace bryozoan, 7 May 1997, coll. K. B. Attwood (NSW 1358); paratypes many specimens, AM P.77145, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 19 m, on surface of sponges, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1278); paratypes 10 specimens, AM P.77148, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 17 m, bryozoan *Margaretta barbata* on wall,1 May 1997, coll. P. B. Berents (NSW 1280); paratypes 6 specimens, AM P.77150, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 18 m, hydrozoan and bryozoan, 1 May 1997, coll. P. B. Berents (NSW 1281); paratypes many specimens, AM P.77151, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 17 m, airlift over rock wall, 1 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1282); paratypes 2 specimens, AM P.77157, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 18 m, sponge and gorgonacean, 1 May 1997, coll. K. B. Attwood (NSW 1286); paratypes 2 specimens, AM P.77159, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 16 m, orange compound ascidian growing on wall, 1 May 1997, coll. K. B. Attwood (NSW 1287); paratypes 3 specimens, AM P.77160, 150 m east of Burrill Rocks, Ulladulla (35°23'24"S 150°28'10"E), 17 m, dead bryozoan encrusted with algae, Bryozoa and hydroids, 1 May 1997, coll. K. B. Attwood (NSW 1288); paratypes 10 specimens, AM P.77182, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 24 m, gorgonacean, 7 May 1997, coll. R. Springthorpe (NSW 1349); paratypes many specimens, AM P.77184, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 21 m, low tufting brown and coralline algae, 7 May 1997, coll. A. Murray (NSW 1351); paratypes 2 specimens, AM P.77186, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 22 m, red alga with sponges attached, 7 May 1997, coll. K. B. Attwood (NSW 1352); paratypes many specimens, AM P.77188, Burrill Rocks, Ulladulla (35°23'23"S 150°28'14"E), 22 m, red alga, 7 May 1997, coll. A. Murray (NSW 1356).

Type locality. Burrill Rocks, Ulladulla, New South Wales, Australia (35°23'23"S 150°28'14"E).

Etymology. From the term "vulgar" meaning common.

Additional material examined. *New South Wales*. 1 specimen, AM P.77141, southern end of Lighthouse Reef, Ulladulla (35°22'8"S 150°29'18"E), 16 m, red algal turf, 30 April 1997, coll. A. Murray (NSW 1274); 2 specimens, AM P.77161, Golf Course Bommie, 500 m northeast of Ulladulla Head (35°20'28"S 150°29'12"E), 9 m, brown turf algae, 2 May 1997, coll. A. Murray (NSW 1289); 1 specimen, AM P.77164, Halfway Reef, 200 m south of Sullivan Reef, Ulladulla (35°21'25"S 150°29'18"E), 13 m, red algae on rock ledges at base of wall, 3 May 1997, coll. A. Murray (NSW 1300); 8 specimens, AM P.77169, Halfway Reef, 200 m south of Sullivan Reef, Ulladulla (35°21'25"S 150°29'18"E), 15 m, airlift over wall of sponges, Bryozoa, Hydrozoa, 3 May 1997, coll. P. B. Berents, K. B. Attwood and A. Murray (NSW 1307); many specimens, AM P.77173, 50 m east of Sullivan's Reef, Ulladulla (35°21'19"S 150°29'22"E), 23 m, airlift over rocks, 5 May 1997, coll. P. B. Berents and R. Springthorpe (NSW 1323); 11 specimens, AM P.77176, 50 m east of Sullivan's Reef, Ulladulla (35°21'19"S 150°29'22"E), 24 m, gorgonacean, 5 May 1997, coll. P. B. Berents (NSW 1326); 8 specimens, AM P.77177, 50 m east of Sullivan's Reef, Ulladulla (35°21'19"S 150°29'22"E), 24 m, gorgonacean, 5 May 1997, coll. P. B. Berents (NSW 1327); 2 specimens, AM P.77178, 50 m east of Sullivan's Reef, Ulladulla (35° 21' 20" S, 150° 29' 22" E), 23 m, algal turf, 5 May 1997, coll. A. Murray (NSW 1329); 1 specimens, AM P.62733, Botany Bay (33°58'11"S 151°11'9"E), 16.5 m, sandy mud, 27 October 1994, coll. Australian Museum Party (FAC2 06Bot1/3b); 2 specimens, AM P.22292, east of Long Reef (33°44'S 151°22'E), 38 m, 24 August 1972, coll. Australian Museum Party; many specimens, AM P.77325, east of Long Reef, (33°44'S 151°22'E), 36 m, 11 May 1973, coll. Australian Museum Shelf Benthic Survey; 2 specimens, AM P.22279, east of North Head, Port Jackson (33°49'S 151°20'E), 25 m, 26

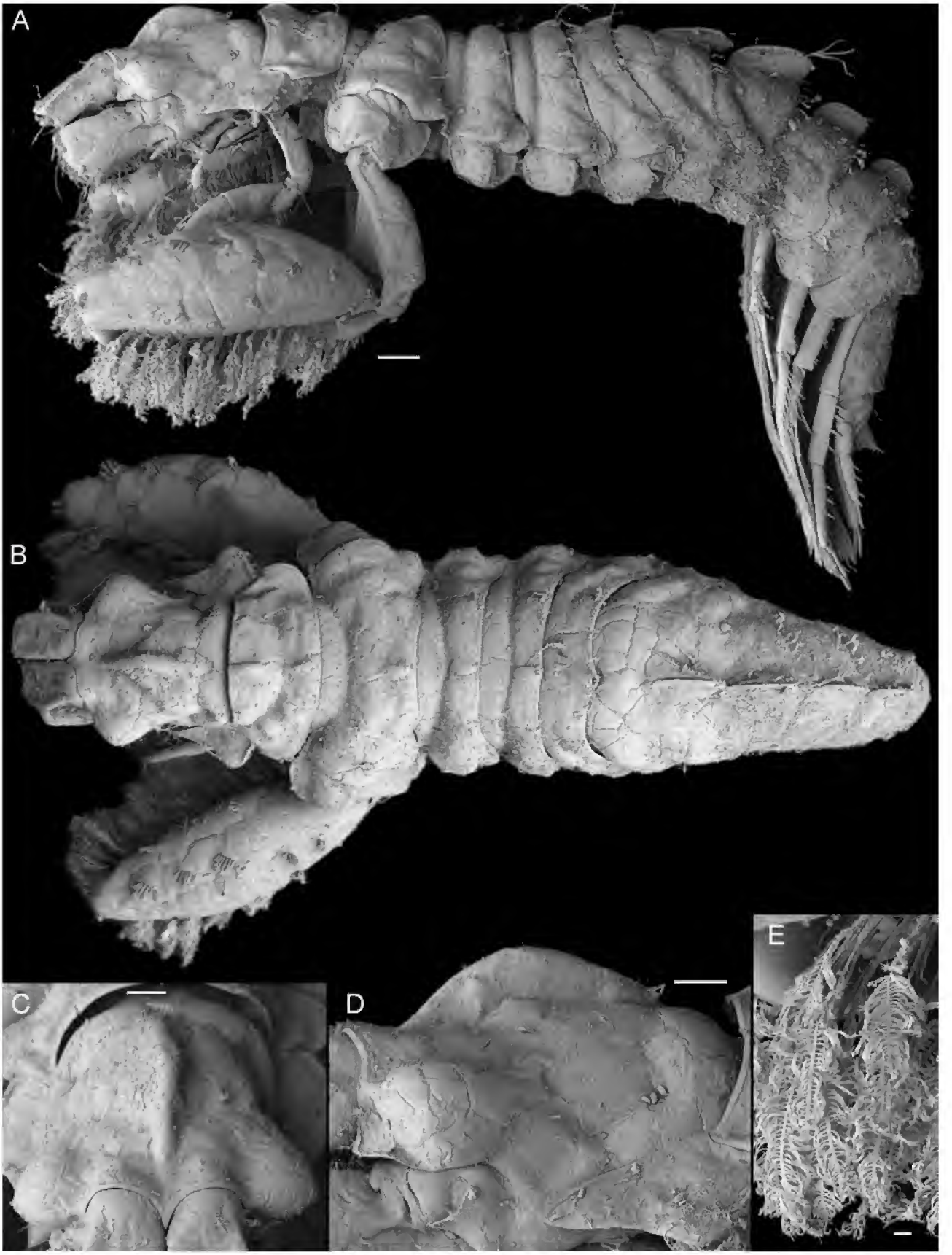

Figure 31. *Podocerus vulgaris* sp. nov. male specimen, AM P.84115, Ulladulla, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 200 μm); *(C)* head frontal view (scale 100 μm); *(D)* head lateral view (scale 100 μm) and *(E)* gnathopod 2 propodus palm plumose setae.

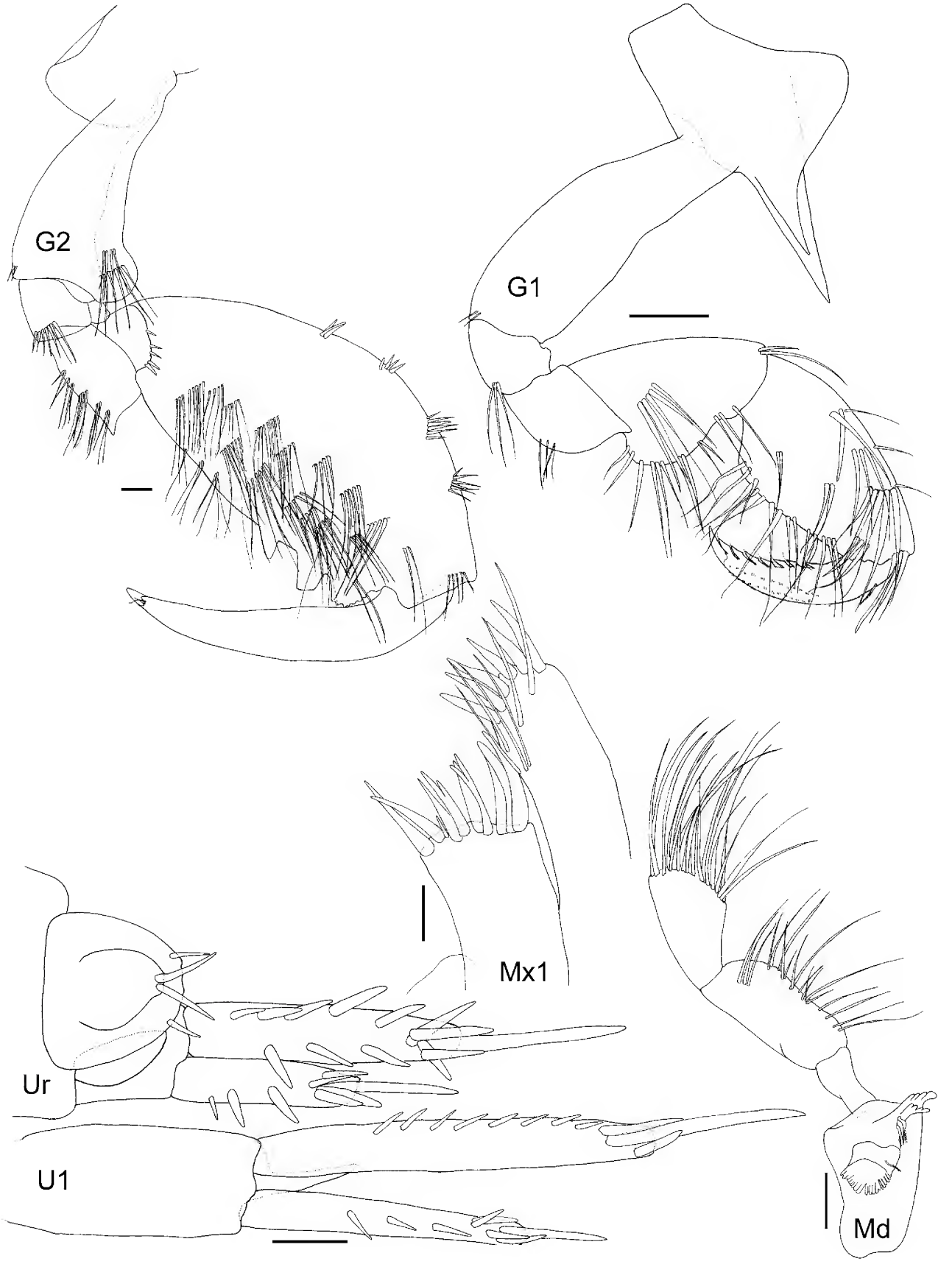

Figure 32. *Podocerus vulgaris* sp. nov., holotype male, AM P.86193, 6.2 mm, Ulladulla, New South Wales (scales represent 0.1 mm).

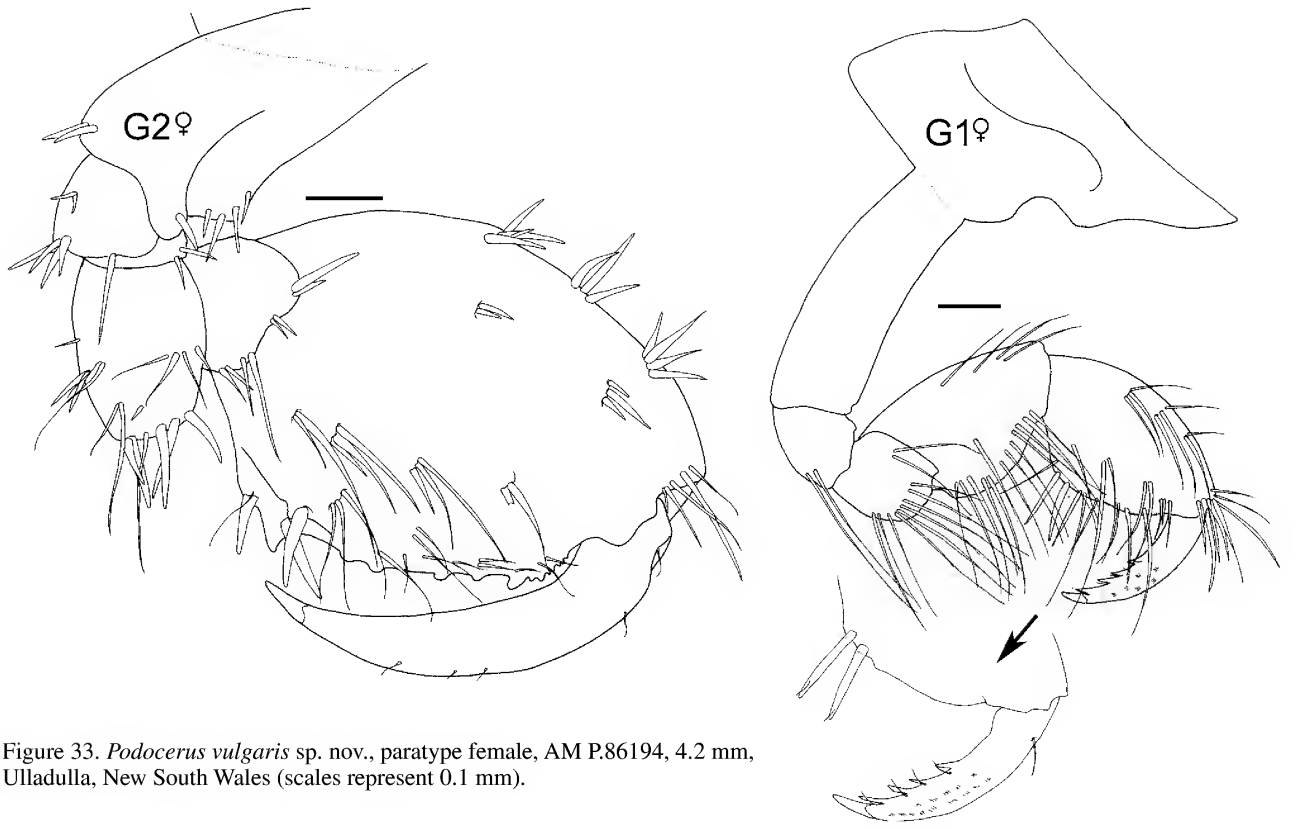

Figure 33. *Podocerus vulgaris* sp. nov., paratype female, AM P.86194, 4.2 mm, Ulladulla, New South Wales (scales represent 0.1 mm).

February 1973, coll. Australian Museum Shelf Benthic Survey; 4 specimens, AM P.22288, east of North Head, Port Jackson (33°49'S 151°20'E), 25 m, on host sponge: *Holopsamma flavus*, February 1973, coll. Australian Museum Shelf Benthic Survey; 19 specimens, AM P.36019, Quarantine Bay, Twofold Bay (37°4'42"S 149°53'E), 2 m, airlift in seagrass *Posidonia* sp., 9 October 1984, coll. S. J. Keable and J. T. van der Velde (Q8); 14 specimens, AM P.36231, Munganno Point, Twofold Bay (37°6'12"S 149°55'42"E), 3.5 m, subtidal rock platform, 10 October 1984, coll. P. A. Hutchings (M3); many specimens, AM P.77130, Munganno Point, Twofold Bay (37°6'12"S 149°55'42"E), subtidal wharf pile, 19 December 1983, coll. S. J. Keable and S. J. Perry (STN M7); 2 specimens, AM P.77181, northern side of Bannister Head, north of Batemans Bay (35°19'9"S 150°29'7"E), 18 m, airlift of sand from under and around stones, 6 May 1997, coll. K. B. Attwood and R. Springthorpe (NSW 1347); many, AM P.77202, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Peyssonnelia nova-hollandiae*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1985); many specimens, AM P.77204, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Curdiea crassa* with small amount of red alga *Martensia australis*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1986); many specimens, AM P.77205, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Curdiea crassa* with small amount of red alga *Martensia australis*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1986); many specimens, AM P.77206, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Curdiea crassa* with small amount of red alga *Martensia australis*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1986); many specimens, AM P.77209, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); 1 specimen, AM P.77213, south of Broulee Island, south of Batemans Bay (35°50'49"S 150°11'5"E), 8 m, brown macroalga *Zonaria diesingiana*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1991); 2 specimens, AM P.77214, south of Broulee Island, south of Batemans Bay (35°50'49"S 150°11'5"E), 8 m, brown macroalga *Zonaria diesingiana*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1991); many specimens, AM P.77215, gutters north of Burrewarra Point, south of Batemans Bay (35°49'49"S 150°14'1"E), 24 m, brown macroalga *Stypopodium flabelliforme*, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1992); many specimens, AM P.77216, gutters north of Burrewarra Point, south of Batemans Bay (35°49'49"S 150°14'1"E), 24 m, from red macroalga *Pachymenia prostrata*, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1993); many specimens, AM P.77218, gutters north of Burrewarra Point, south of Batemans Bay (35°49'49"S 150°14'1"E), 24 m, branching hydroid, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1995); many specimens, AM P.77219, gutters north of Burrewarra Point, south of Batemans Bay (35°49'49"S 150°14'1"E), 24 m, red macroalga *Pachymenia prostrata*, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1996); many specimens, AM P.77220, gutters north of Burrewarra Point, south of Batemans Bay (35°49'51"S 150°14'4"E), 23 m, from green macroalga *Codium lucasii*, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1997); 4 specimens, AM P.77221, gutters, Burrewarra Point, south of Batemans Bay (35°49'52"S 150°14'17"E), 23 m, from green macroalga *Caulerpa hodgkinsoniae*, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1998); many specimens, AM P.77223, gutters north of Burrewarra Point, south of Batemans Bay (35°49'49"S 150°14'1"E), 23 m, from red macroalga *Thamnoclonium dichotomum* and sponge *Terpios symbioticus*, 27 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 2000); 2 specimens, AM P.77224, northwest side of Tollgate Islands, Batemans Bay (35°44'49"S 150°15'31"E), 7.9 m, brown macroalga *Colpomenia sinnuosa*, 28 October 2002, coll. G. D. F. Wilson and A. J. Millar (NSW 2002); many specimens, AM P.77232, north of Broulee Island, south of Batemans Bay (35°51'20"S 150°11'38"E), 16 m, brown macroalga *Lobophora variegata*, 30 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 2016); 14 specimens, AM P.77235, northwest side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 12 m, red alga *Pterocladiella capillacea*, 8 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. Wilson (NSW 2025); many specimens, AM P.77236, north west side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 12 m, kelp *Ecklonia radiata*, 9 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2026); 8 specimens, AM P.77238, north west side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 16.9 m, green alga *Caulerpa flexilis* gutters, 9 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2027); many specimens, AM P.77240, north west side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 16.2 m, brown macroalga *Zonaria diesingiana* in gutters, 9 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2029); many specimens, AM P.77241, north west side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 16.2 m, brown macroalga *Zonaria diesingiana* gutters, 9 February 2003, coll. P. B.

Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2029); many specimens, AM P.77242, northwest side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 14 m, brown alga *Padina* sp., 9 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2030); 7 specimens, AM P.77243, northwest side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 16 m, brown macroalga *Zonaria diesingiana* gutters, 9 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2033); 4 specimens, AM P.77244, southwest side of Grasshopper Island, northeast of Point Upright (35°38'1"S 150°19'51"E), 13 m, red macroalga *Peyssonnelia novae holliandiae* gutters, 10 February 2003,coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2038); 14 specimens, AM P.77246, west side of Wasp Island, north of Batemans Bay (35°40'2"S 150°18'29"E), 16 m, red macroalga *Curdiea crassa* gutters, 10 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2043); 1 specimen, AM P.77247, west side of Wasp Island, north of Batemans Bay (35°40'2"S 150°18'29"E), 16 m, red macroalga *Curdiea crassa* gutters, 10 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2043); 1 specimen, AM P.77249, west side of Wasp Island, north of Batemans Bay (35°40'2"S 150°18'29"E), 16 m, red alga *Lomentaria catenata* gutters, low profile reefs, rocks and sand, 10 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2046); many specimens, AM P.77250, west side of Wasp Island, north of Batemans Bay (35°40'2"S 150°18'29"E), 16 m, red macroalgae *Peyssonnelia novae holliandiae* gutters, 10 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2047); 1 specimen, AM P.77251, west side of Wasp Island, north of Batemans Bay (35°40'2"S 150°18'29"E), 10 m, green alga *Codium saccatum* gutters, 10 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. Wilson (NSW 2049); 1 specimen, AM P.77252, west side of Wasp Island north of Batemans Bay, north of Batemans Bay (35°40'5"S 150°18'29"E), 10–16 m, green alga *Codium harveyi* gutters low profile reefs, rocks and sand, 10 February 2003, coll. P. B. Berents, A. J. Millar, J. Eu and G. D. F. Wilson (NSW 2050); 11 specimens, AM P.77253, west side of North Tollgate Island, Batemans Bay (35°44'55"S 150°15'27"E), 9 m, green alga *Caulerpa cactoides* gutters, 11 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2052); 1 specimen, AM P.77305, 100 m north, west of Julian Rocks (28°36'48"S 153°37'48"E), 16 m, brown alga *Zonaria* sp., 3 March 1992, coll. G. D. F. Wilson, R. Springthorpe and L. Albertson (NSW 638); 5 specimens, AM P.77306, 100 m north, west of Split Solitary Island (30°14'S 153°10'48"E), 17 m, brown algae, 7 March 1992, coll. S. J. Keable (NSW 694); many specimens, AM P.77308, Quarantine Bay, Twofold Bay (37°4'42"S 149°53'E), 2 m, airlift in seagrass *Posidonia* sp., 28 March 1985, coll. S. J. Keable and A. C. Paul (site Q6); many specimens, AM P.77309, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), subtidal rock platform fauna, 11 December 1984, coll. S. J. Keable and E. A. Bamber (site Q2); 2 specimens, AM P.77310, Quarantine Bay, Twofold Bay (37°4'42"S 149°53'E), crevice and cryptic fauna in *Posidonia* sp. seagrass beds, 11 December 1984, coll. S. J. Keable and E. A. Bamber (Site Q3); many specimens, AM P.77312, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), 3 m, subtidal cryptic fauna rocks, 9 October 1985, coll. S. J. Keable and J. T. van der Velde (site Q5); many specimens, AM P.77313, Quarantine Bay, Twofold Bay (37°4'42"S 149°53'E), 2 m, airlift in seagrass *Posidonia* sp., 25 March 1985, coll. S. J. Keable and A. C. Paul (site Q6); 12 specimens, AM P.77314, Quarantine Bay, Twofold Bay (37°4'42"S 149°53'E), 2 m, airlift in seagrass *Posidonia* sp., 9 October 1984, coll. S. J. Keable and J. T. van der Velde (site Q7); many specimens, AM P.77315, Quarantine Bay, Twofold Bay (37°4'42"S 149°53'E) airlift in seagrass *Posidonia* sp., 25 June 1985, coll. S. J. Keable and A. L. Reid (Q8); 3 specimens, AM P.77318, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), 3 m, subtidal breakwall, 17 September 1985,coll. P. A. Hutchings and S. J. Keable (Q9); 9 specimens, AM P.77207, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Curdiea crassa* with small amount of red alga *Martensia australis*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1986); 16 specimens, AM P.77226, northwest side of Tollgate Islands, Batemans Bay (35°44'49"S 150°15'31"E), 7.9 m, from red macroalga *Chondria succulenta*, 28 October 2002, coll. G. D. F. Wilson and A. J. Millar (NSW 2003); many specimens, AM P.77237, northwest side of Brush Island, north of Batemans Bay (35°31'39"S 150°24'57"E), 12 m, kelp *Ecklonia radiata* gutters, 9 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2026); many specimens, AM P.86195, gutters, north of Burrewarra Point (35°49'51"S 150°14'4"E), 23 m, from macroalga *Martensia australis*, 27 October 2002, coll. G. Wilson, A. Millar and N. Yee (NSW 1999); 2 specimens, AM P.86196, north of Jimmies Island, Batemans Bay (35°48'56"S 150°14'6"E), 16 m, brown macroalga *Dictyota dichotoma*, 29 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 2010); 2 specimens, AM P.86208, The Culvert, Back Creek, South West Rocks, (30°53.045'S 153 01.384'E), mud, sieved at low tide, 21 February 2003, coll. P. Hutchings and K. Attwood, (ex NSW 2082; NSW 2083); 1 specimens, AM P.86197, southern end of Lighthouse Reef, Ulladulla (35°22.14'S 150°29.31'E), 15 m, underside of large boulder, 30 April 1997, coll. P. Berents and K. Attwood (NSW 1265); many specimens, Montague Island (36°15'S 15014'E), 5 m, algal washings, December 1978, coll. A. Kuiter; 1 male specimen, dissected, 1 slide, AM P.86213, north west of Blue Fish Point, North Head, north of Port Jackson, (33°48'06.9"S 151°18'00.8"E), 15–18 m, red alga, 12 November 2010, coll. S. J. Keable, RV *Baragula* (NSW 4011); 5 specimens, AM P.86214, north west of Blue Fish Point, North Head, north of Port Jackson, (33°48'06.9"S 151°18'00.8"E), 15–18 m, red alga, 12 November 2010, coll. S. J. Keable, RV *Baragula* (MI NSW 4011).—*Tasmania*: 2 specimens, AM P.83744, north side of Esperance Point, D'Entrecasteaux Channel (43°19'30"S 147°05' 30"E), 12 m, sponges, 18 April 1991, coll. Australian Museum Party (Tas 183); 4 specimen, AM P. 86198, Elephant Rock north of St Helens Point (41°17.5'S 148°20'E), 20 m, red algae, 14 April 1991, coll. R. T. Springthorpe and C. J. McCormick (Tas 132).—*South Australia*. 2 specimens, SAMA C6592, Sellicks Beach, Fleurieu Peninsula (35°19'47"S 138°26'52"E), 16 January 1937, coll. H. M. Hale and K. Sheard.—*Western Australia*. Many specimens, AM P.79834, South Mole, Port Harding Torbay, Fremantle (32°3'S 115°44'E), 6 m, spirorbid polychaete tubes, 25 December 1983, coll. J. K. Lowry (WA 283); 12 specimens, AM P.79836, off end of South Mole, 2 km south of Cape Peron, Fremantle (32°3'S 115°44'E), 6 m, red gorgonacean, 25 December 1983, coll. R. T. Springthorpe (WA 288); many specimens, AM P.79839, off end of South Mole, Exmouth Gulf, Fremantle (32°3'S 115°44'E), 6 m, sponges, 25 December 1983, coll. J. K. Lowry (WA 276); many specimens, AM P.79841, South Mole, Arthur Head, Fremantle (32°3'S 115°44'E), 6 m, spirorbid polychaete worms, 25 December 1983, coll. J. K. Lowry (WA 283); 11 specimens, AM P.79842, off end of South Mole, Arthur Head, Fremantle (32°3'S 115°44'E), 6 m, green algae *Caulerpa* sp., 25 December 1983, coll. J. K. Lowry (WA 281); 9 specimens, AM P.79838, South Mole, Arthur Head, Fremantle (32°3'S 115°44'E), 6 m, spirorbid polychaete tubes, 25 December 1983, coll. J. K. Lowry (WA 283); 2 specimens, AM P.79837, reef west of groyne, Arthur Head (32°16'S 115°41'E), 6 m, deep channels in limestone reef, sponges, gorgonaceans from cave in reef, 26 December 1983, coll. J. K. Lowry (WA 295); 1 specimen, AM P.79848, off end of South Mole, Arthur Head, Fremantle (32°3'S 115°44'E), 6 m, sponge, detritus, epizoic green algae *Caulerpa* sp., 25 December 1983, coll. J. K. Lowry (WA 287); 4 specimens, AM P.79840, Bundegi Reef near Point Murat, Arthur Head, Fremantle (21°49'S 113°11'E), 9 m, dead encrusted coral, 4 January 1984, coll. R. Springthorpe (WA 406); many specimens, AM P.79847, off end of South Mole, Arthur Head, Fremantle (32°3'S 115°44'E), 6 m, sponges, 25 December 1983, coll. J. K. Lowry (WA 276); 2 specimens, AM P.79835, Migo Island, Arthur Head, Fremantle (35°4'S 117°39'E), 7 m, molluscs on rocks, 15 December 1983, coll. J. K. Lowry (WA 141).

Diagnosis. *Head* with well developed hump. *Gnathopod 1* without robust setae. *Gnathopod 2* propodus elongate subovoid, palm with 2 teeth, one rectangular and one subtriangular, palm without defining corner or robust setae. *Pereonite 6* dorsal carina subtriangular, produced posteriorly, apically subacute. *Pereonite 7* dorsal carina subtriangular, produced posteriorly, apically subacute. *Pleonite 1* dorsal carina subrectangular, produced anteriorly. *Pleonite 2* dorsal carina produced evenly, broadly rounded.

Female. *Gnathopod 1* carpus rectolinear, 1.8 times as long as broad; propodus subtriangular, 1.8 times as long as broad. *Gnathopod 2* merus posterior margin produced lobe broad, twice as broad as long, apically truncate, with 5 robust setae; propodus spherical, with posterodistal shelf, shelf margin strongly crenulated, palm lined with 4 humps, defined by tooth and 3 robust setae.

Description. Based on holotype male, 6.2 mm, AM P.86193. *Body* cuticle dorsally processiferous, with mainly posterior dorsal carina, without lateral and ventral carina. *Head* with well developed hump; *eyes* greatly bulging; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Mandible* accessory setal row with 3 setae. *Maxilla 1* palp distal margin with 6 robust setae.

Pereonites 1–5 without dorsal carina. *Coxae 1–3* discontiguous, *coxae 4–7* contiguous. *Gnathopod 1* coxa

larger than coxa 2, as broad as long, distoventral corner produced anteriorly, corner subacute; basis 3.1 times as long as broad, without anterodistal setae; carpus subtriangular, 2.1 times as long as broad; propodus subrectangular, 2.1 times as long as broad, anterior margin with clusters of long slender setae, palm acute, straight, margin smooth, without robust setae; dactylus posterior margin with 7 serrate teeth, cuticle surface with raised serrations, closing along palm. *Gnathopod 2* basis twice as long as broad, anterodistal corner produced lobes rounded, with a few plumose setae; merus anterior margin with narrow produced lobe, as long as broad, apically acute; propodus elongate subovoid, 2.1 times as long as broad, anterior margin with clusters of short robust setae, palm acute, straight, with broad, well developed distal shelf, shelf margin strongly crenulated, palm with 2 teeth, one rectangular and one subtriangular, palm without defining corner or robust setae; dactylus closing along palm margin. *Pereonite 6* dorsal carina subtriangular, produced posteriorly, apically subacute. *Pereonite 7* dorsal carina subtriangular, produced posteriorly, apically subacute.

Pleonite 1 dorsal carina subrectangular, produced anteriorly; *epimeron 1* posteroventral corner rounded. *Pleonite 2* dorsal carina produced evenly, broadly rounded. *Epimera 2–3* posteroventral corner rounded. *Urosome* with 3 pairs of uropods. *Urosomite 1* short, twice as long as broad. *Uropod 1* peduncle 3 times as long as broad, with well developed ventromedial spine, 4 times as long as broad; inner ramus 1.6 times peduncle length; outer ramus about half the length of inner ramus. *Uropod 2* well developed, biramus, without ventromedial spine; outer ramus about half the length of inner ramus. *Telson* dorsal lobe with 2 apical setae; lower margin with pair of slender apical setae.

Female (sexually dimorphic characters) based on paratype female specimen, 4.2 mm, AM P.86194. *Gnathopod 1* basis anterior margin without robust setae; carpus rectolinear, 1.8 times as long as broad; propodus subtriangular, 1.8 times as long as broad, palm straight defined by corner with 2 robust setae; dactylus posterior margin with 4 serrate teeth. *Gnathopod 2* basis anterodistal corner with many robust setae; merus posterior margin produced lobe broad, twice as broad as long, apically truncate, with 5 robust setae; propodus spherical, 1.3 times as long as broad, anterior margin with clusters of long robust setae, palm weakly convex, ⅔ length of propodus, with posterodistal shelf, shelf margin strongly crenulated, palm lined with 4 humps, defined by tooth and 3 robust setae.

Remarks. *Podocerus vulgaris* sp. nov. is similar to *P. cristatus, P. dentatus* and *P. oliphant* sp. nov. in the dorsal carination pattern. *Podocerus vulgaris* sp. nov. and *P. oliphant* sp. nov.have the male gnathopod 2 propodus palm with two distal teeth, while *P. cristatus* and *P. dentatus* have one palmar tooth. The male gnathopod 2 propodus palm with small defining tooth separates *P. oliphant* sp. nov. from *P. vulgaris* sp. nov. which has a smooth unornamented gnathopod 2 posterior margin. *Podocerus vulgaris* sp. nov. is the most commonly collected *Podocerus* species for southern Australia.

Distribution. Australia. *New South Wales*. Long Reef, Port Jackson, Botany Bay, Ulladulla, Batemans Bay, Twofold Bay (current study). *Tasmania*. D'Entrecasteaux Channel (current study). *South Australia*. Fleurieu Peninsula (current study). *Western Australia*. Fremantle (current study).

Podocerus wanganui J. L. Barnard, 1972

Figs 34–37

Podocerus wanganui J. L. Barnard, 1972: 152–153, figs 85–86.

Type locality. St Clair, Dunedin, New Zealand.

Material examined. *New South Wales*. 1 male specimen, 8.8 mm, dissected, 3 slides, AM P.86199, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red coralline alga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); 1 female specimen, 6.7 mm, dissected, 1 slide, AM P.86200, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red coralline alga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); 19 specimens, AM P.77210, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red coralline alga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); 1 SEM pin mounted specimen, AM P.78199, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from macroalga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); 1 SEM pin mounted specimen, AM P.78200, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red coralline alga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); 1 SEM pin mounted specimen, AM P.78201, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red coralline alga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); 2 specimens, AM P.77203, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Peyssonnelia nova-hollandiae*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1985); 3 specimens, AM P.77208, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red macroalga *Curdiea crassa* with small amount of red alga *Martensia australis*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1986); 19 specimens, AM P.77210, East Wall, north of Burrewarra Point, south of Batemans Bay (35°50'1"S 150°14'9"E), 25 m, from red coralline alga *Corallina berteri*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1987); 1 specimen, AM P.77227, west side of North Tollgate Island, Batemans Bay (35°44'46"S 150°15'28"E), 12 m, from brown macroalga *Sporochnus radiciformis*, 28 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 2006); many specimens, AM P.77228, north of Jimmies Island (35°48'56"S 150°14'6"E), 16 m, macroalga *Solieria robusta*, 29 October 2002, coll. A. J. Millar, N. Yee and G. D. F. Wilson (NSW 2008); 1 specimen, AM P.77231, northwest side of Tollgate Islands, Batemans Bay (35°44'45"S 150°15'26"E), 12 m, from macroalga *Sargassum* sp. 2, 29 October 2002, coll. G. Wilson and N. Yee (NSW 2015); 1 specimen, AM P.77245, southwest side of Grasshopper Island, Batemans Bay (35°38'1"S 150°19'51"E), 11 m, brown alga *Halopteris platycena* gutters, 10 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2041); 1 specimen, AM P.77255, west side of North Tollgate Island, Batemans Bay (35°44'55"S 150°15'27"E), 9 m, red macroalga *Chondria succulenta* gutters, 11 February 2003, coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2053); 3 specimens, AM P.77256, North Kianinny Gutter, Tathra (36°44'3"S 149°59'12"E), 5 m, red alga *Pterocladia lucida* gutters, 12 February 2003,coll. P. B. Berents, J. Eu, A. J. Millar and G. D. F. Wilson (NSW 2060); 9 specimens, AM P.36232, Munganno Point, Twofold Bay (37°6'12"S 149°55'42"E), 3 m, subtidal wharf pile, 10 October 1984, coll. S. J. Keable and J. T. van der Velde (M2); 9 specimens, AM P.36233, Quarantine Bay, Twofold Bay (37°4'42"S 149°53'E), 2 m, airlift in seagrass *Posidonia* sp., 9 October 1984, coll. S. J. Keable and J. T. van der Velde (Q7); many specimens, AM P.77128, Munganno Point, Twofold Bay (37°6'12"S 149°55'42"E), subtidal rocks, crevice fauna and algal waxing, 10 October 1984, coll. P. A. Hutchings and S. J. Keable (M3); many specimens, AM P.77131, Munganno Point, Twofold Bay (37°6'12"S 149°55'42"E), 15 m, subtidal wharf pile, 27 June 1985, coll. S. J. Keable and A. L. Reid (M8); 1 specimen, AM P.77230, northwest side of Tollgate Islands, Batemans Bay (35°44'45"S 150°15'27"E), 12 m, brown alga *Padina australis*, 29 October 2002, coll. G. D. F. Wilson and N. Yee (NSW 2014); many specimens, AM P.77316, Quarantine Bay, Twofold Bay (37°4'42"S 149°53'E), airlift in seagrass *Posidonia* sp., 25 June 1985, coll. S. J. Keable and A. L. Reid (Q8); many specimens, AM P.77317, Murrumbulga Point, Twofold Bay (37°4'42"S 149°53'6"E), 2 m, subtidal rock, 29 March 1985, coll. S. J. Keable and J. T. van der Velde (Q9); 4 specimens, AM P.77123,

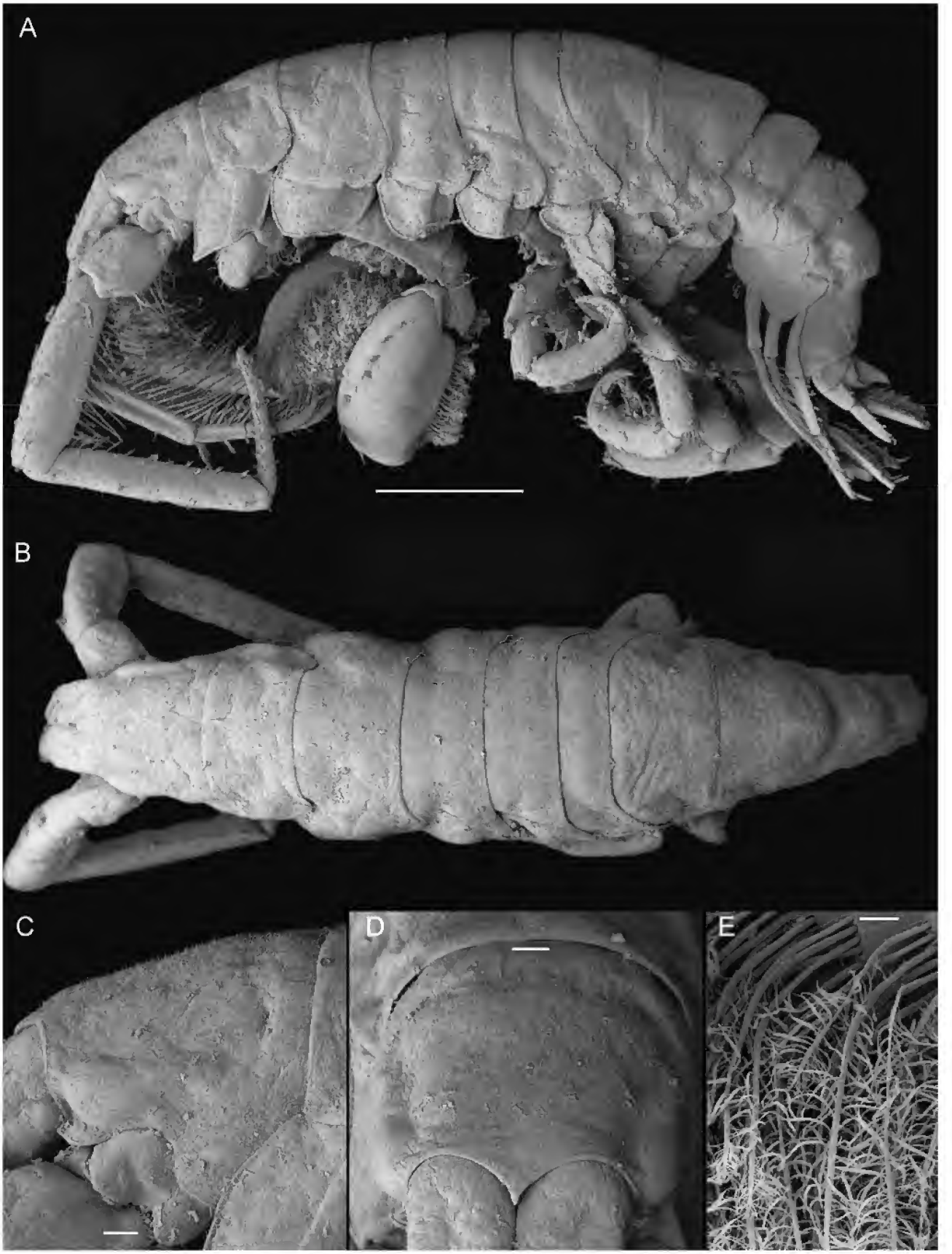

Figure 34. *Podocerus wanganui* J. L. Barnard, 1972 male specimen, AM P.78201, Batemans Bay, New South Wales. SEM photographs: *(A)* whole animal lateral view; *(B)* whole animal dorsal view (scale 100 µm); *(C)* head lateral view (scale 100 µm); *(D)* head frontal view (scale 100 µm); and *(E)* gnathopod 2 propodus palm plumose setae (scale 20 µm).

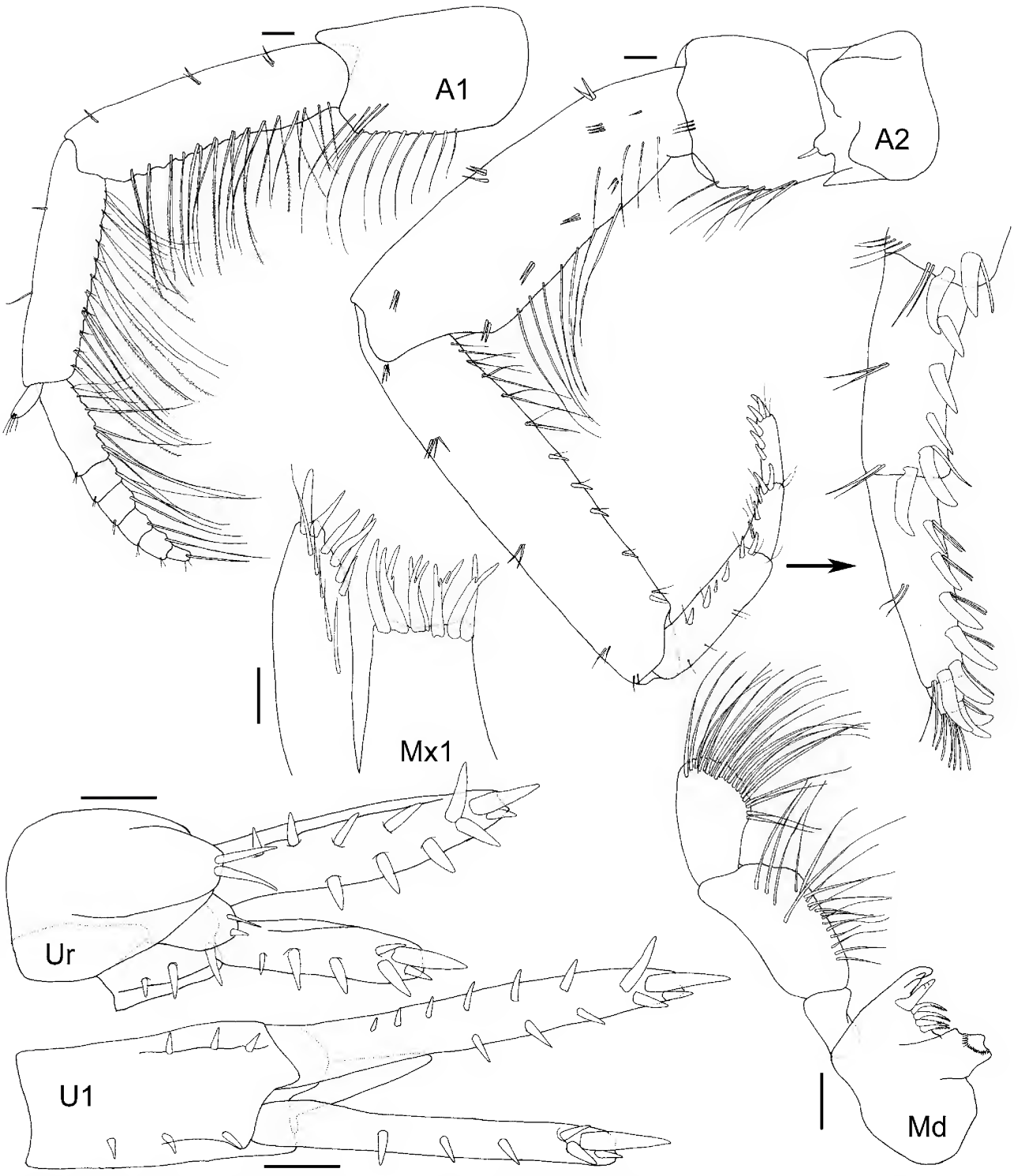

Figure 35. *Podocerus wanganui* J. L. Barnard, 1972 male, AM P.86199, 8.8 mm, Batemans Bay, New South Wales (scales represent 0.1 mm).

Cape Banks, Botany Bay (34°S 151°15'E), 1 February 1985; 4 specimens, AM P.77124, Cape Banks, Botany Bay (34°S 151°15'E), 1 February 1985; 7 specimens, AM P.86201, south of Broulee Island (35°50'49"S 150°11'5"E), 8 m, from red macroalga branching corallines: *Amphiora anceps* and *Jania natalensis*, 25 October 2002, coll. G. D. F. Wilson, A. J. Millar and N. Yee (NSW 1989); 2 specimens, AM P.86202, outer Latitude Rock, Forster (32°12'39"S 152°34'06"E), 12 m, hydroids, 18 March 2003, coll. P. B. Berents, and R. T. Johnson (NSW 2156); 1 male, dissected, 2 slides, AM P.86203, Montague Island (36°15'S 15014'E), 5 m, algal washings, December 1978, coll. A. Kuiter; 100+ specimens, AM P.86204, Montague Island (36°15'S 15014'E), 5 m, algal washings, December 1978, coll. A. Kuiter.—*Tasmania*. 2 specimens, AM P.86205, Sloop Reef, Bay of Fires (41°13'S 148°17.5'E), 23 m, red alga, rocky bottom, 15 April 1991, coll. R. T. Springthorpe and C. J. McCormick (Tas 151); 5 specimens, AM P.86206, north side of Esperance Point, D'Entrecasteaux Channel (43°19'30"S 147°05' 30"E), 1.5 m, coralline alga, 18 April 1991, coll. P. B. Berents (Tas 177); 1 specimen, AM P.86207, St Helens Rocks (41°17.5'S 148°22'E), 3 m, clumps of a red alga, 13 April 1991, coll. P. B. Berents (Tas 117); 6 specimens, AM P.83641, Lighthouse Bay, south tip of Bruny Island, (43°31'S 147°21'E), 6 m, algal washings, 13 December 1977, coll. C. Short.—*South Australia*. 1 male specimen, dissected, 9.0 mm, 3 slides, NMV J62401, northeastern side of Topgallant Island, Investigator Island

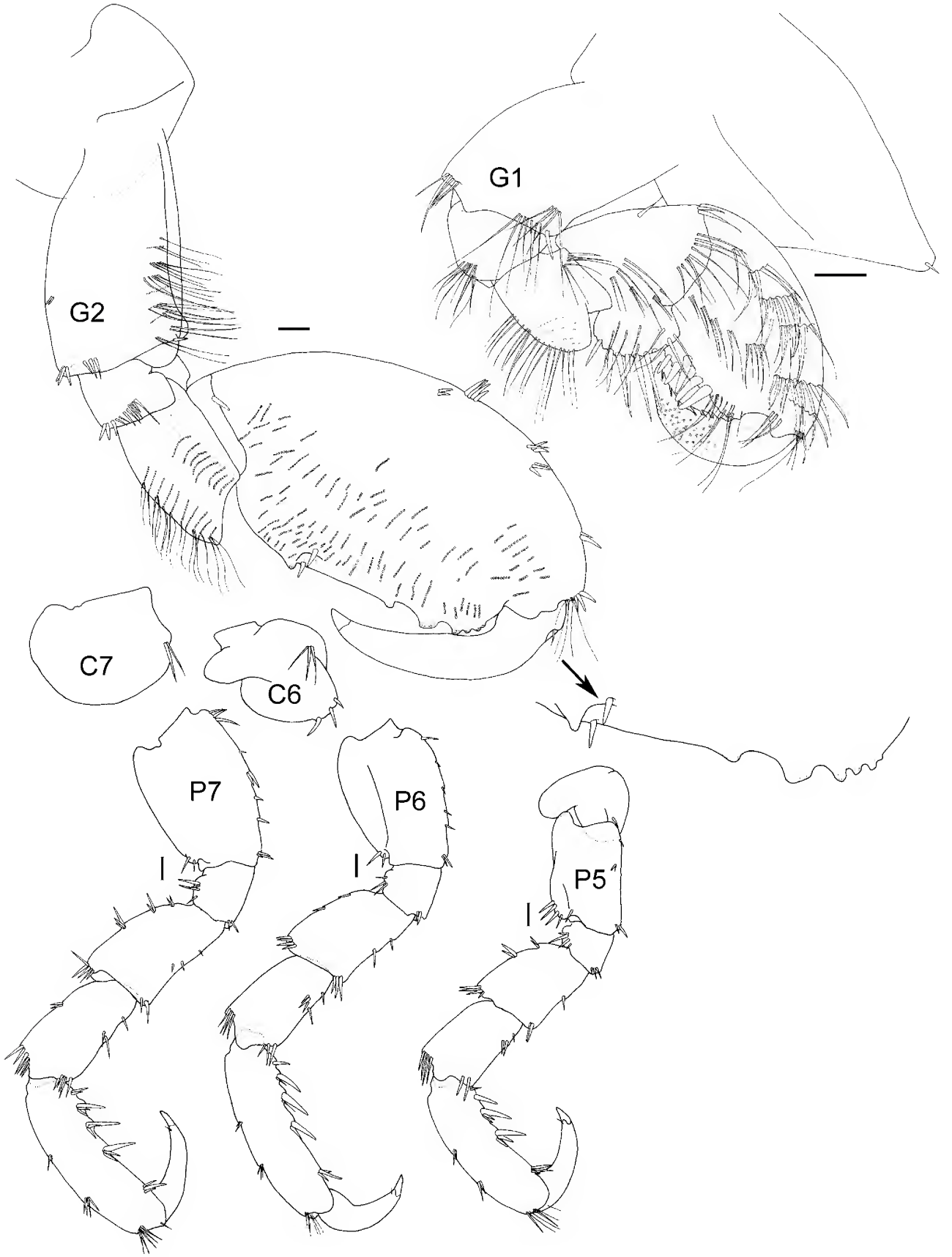

Figure 36. *Podocerus wanganui* J. L. Barnard, 1972 male, AM P.86199, 8.8 mm, Batemans Bay, New South Wales (scales represent 0.1 mm).

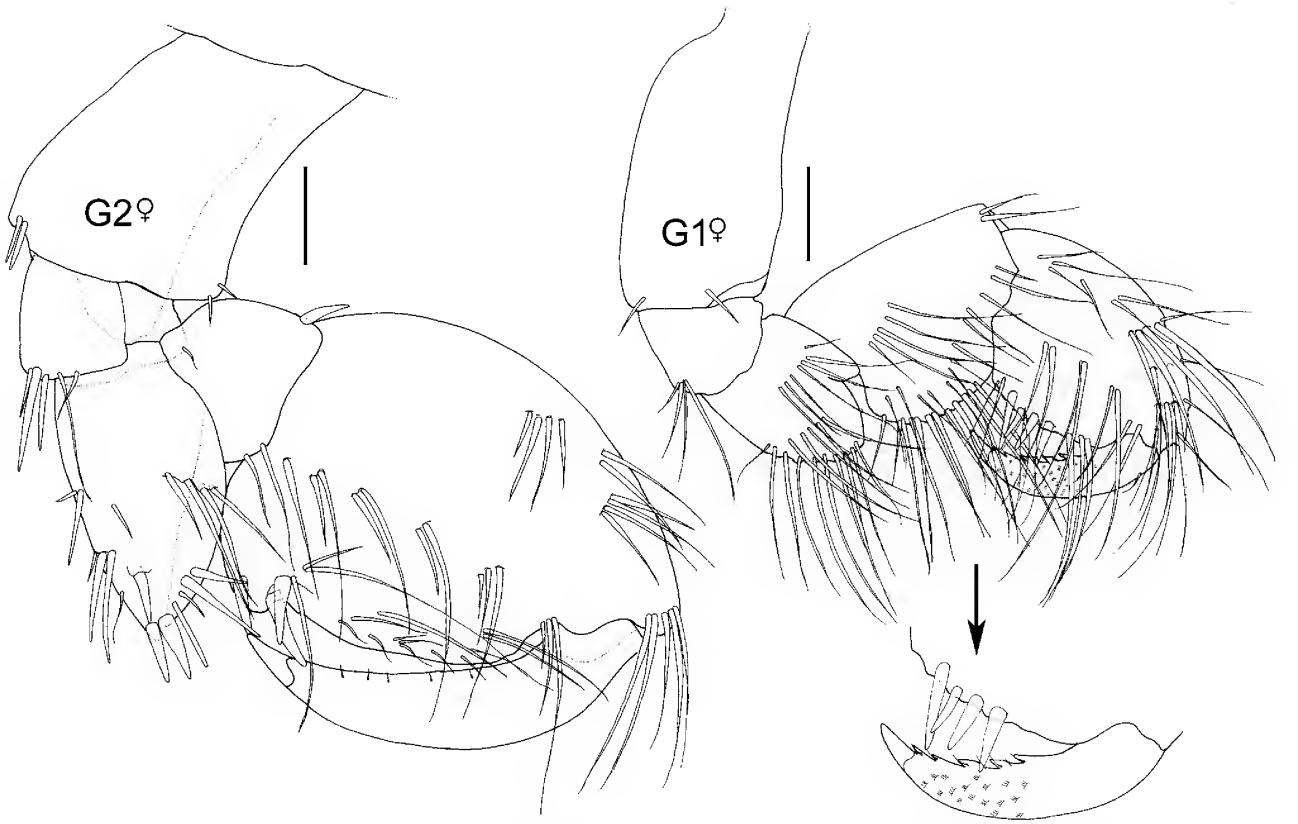

Figure 37. *Podocerus wanganui* J. L. Barnard, 1972 female, AM P.86200, 6.7 mm, Batemans Bay, New South Wales (scales represent 0.1 mm).

Group (33°4'00"S 134°36'36"E), 7 m, 22 April 1985 (SA 83); 1 male specimen, dissected, 5.5 mm, 3 slides, NMV J62402, northeastern side of Topgallant Island, Investigator Island Group (33°4'00"S 134°36'36"E), 7 m, 22 April 1985 (SA 83); many specimens, NMV J62403, northeastern side of Topgallant Island, Investigator Island Group (33°4'00"S 134°36'36"E), 7 m, 22 April 1985(SA 83); 1 specimens, NMV J57130, northeastern side of Topgallant Island, Investigator Island Group (33°43"00'S 134°36"36'E), 16 m, 22 April 1985 (SA 84); 1 specimen, NMV J57050, northeast side of Topgallant Island, Investigator Group (33°43'00"S 134°36'36"E), 20 m, 21 April 1985, (SA 80); 2 specimens, NMV J57054, Venus Bay, southern side of Germein Island (33°13'12"S 134°40'06"E), 2 m, 23 April 1985 (SA 88).—*Western Australia*. Many specimens, AM P.79832, 30 km south of Carnarvon, Vancouver Peninsula, (35°4'S 117°56'E), high intertidal, weed mat, 13 December 1983, coll. H. E. Stoddart (WA 117).

Diagnosis. *Body* cuticle dorsally smooth. *Head* dorsally smooth; *eyes* not protruding from head. *Gnathopod 1* propodus subovate, with 5 robust setae near corner of palm. *Gnathopod 2* propodus subovate, palm with one rectangular and one subtriangular tooth, palm defining corner with tooth and 2 robust setae; dactylus closing short of palm end.

Female. *Gnathopod 1* carpus rectolinear, 1.2 times as long as broad; propodus subtriangular to subovoid, 1.8 times as long as broad, palm smooth weakly convex with 4 robust setae near corner of palm. *Gnathopod 2* merus posterior margin lobe broad produced, broader than long, propodus, palm defined by tooth with 3 robust setae.

Description. Based on male specimen, 8.8 mm, AM P.86199. *Body* cuticle dorsally smooth. *Head* dorsally smooth; *eyes* not protruding from head; lateral cephalic lobe subquadrate; anteroventral corner subquadrate. *Antenna 1* between 0.4 times body length; peduncle article 2 longer than article 3; primary flagellum 0.33 times peduncle length, with 6 articles; accessory flagellum 1-articulate, twice as long as broad. *Antenna 2* distinctly longer than antenna 1; article 4 shorter than article 5; flagellum 0.25 times peduncle length, posterior margin with line of short robust setae, with 4 articles. *Mandible* accessory setal row with 4 setae. *Maxilla 1* palp distal margin with 6 robust setae.

Coxae 1–7 discontiguous. *Gnathopod 1* coxa subequal to coxa 2, longer than broad, distoventral corner weakly produced anteriorly, corner subacute; basis 1.2 times as long as broad, anterodistal margin with slender and robust setae; carpus subtriangular, 1.1 times as long as broad; propodus subovate, 1.9 times as long as broad, anterior margin with clusters of long slender setae, palm margin smooth, with 5 robust setae near corner of palm; dactylus posterior margin with 6 serrate teeth, cuticle surface with raised serrations, closing along palm. *Gnathopod 2* basis 2.1 times as long as broad, anterodistal corner rounded, with dense brush of plumose setae; merus posterior margin with broad produced lobe, as long as broad, apically subacute, without short robust setae; propodus subovate, 2.1 times as long as broad, anterior margin with clusters of short robust setae, palm acute, straight, palm ⅔ length of propodus, with broad, well developed distal shelf, shelf margn crenulated, palm with one rectangular and one subtriangular tooth, palm defining corner, with tooth and 2 robust setae; dactylus closing short of palm end.

Epimeron 1 posteroventral corner rounded. *Epimera 2–3* posteroventral corner subquadrate. *Urosome* with 3 pairs of uropods. *Urosomite 1* short, 1.2 times as long as broad. *Uropod 1* peduncle 2.1 times as long as broad, with well developed ventromedial spine, 4 times as long as broad; inner ramus 1.2 times peduncle length; outer ramus about ¾ length of inner ramus. *Uropod 2* well developed, biramus, without

ventromedial spine; outer ramus about half the length of inner ramus. *Uropod 3* uniramus; rami with 2 apical setae. *Telson* dorsal lobe with 2 apical setae; lower margin without lateral or apical setae.

Female (sexually dimorphic characters) based on female specimen, 6.7 mm, AM P.86200.

Gnathopod 1 basis anterior margin without robust setae; carpus rectolinear, 1.2 times as long as broad; propodus subtriangular to subovoid, 1.8 times as long as broad, palm smooth weakly convex, with 4 robust setae near corner of palm; dactylus posterior margin with 5 serrate teeth. *Gnathopod 2* basis anterodistal corner with produced lobes, rounded, with 2 robust setae; merus posterior margin lobe broad produced, broader than long, apically rounded, with 3 robust setae; propodus subovoid, 1.5 times as long as broad, anterior margin with clusters of long slender setae, palm convex, smooth, without distal shelf, palm defined by tooth with 3 robust setae.

Remarks. The new distribution records extend along the southern coast of Australia (excluding Tasmania) and are a significant range expansion for this species previous known from New Zealand. Material dissected from New South Wales and South Australia show no significant morphological variation from the original description.

Distribution. New Zealand. *Dunedin* (J. L. Barnard, 1974). Australia. *New South Wales*: Forster, Botany Bay, Tathra, Batemans Bay, Twofold Bay, Montague Island (current study). *Tasmania*. St Helens Rock, Bay of Fires, D'Entrecasteaux Channel, Rocky Cape (current study). *South Australia*: Investigator Island Group (current study). *Western Australia*: Vancouver Peninsula (current study).

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